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Low Cost Road Surfacing
and
Pavement Guideline Document

Phase 2 Inception Report

August 2012

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

Launched in June 2008 and managed by Crown Agents, the five year-long, UK government (DFID) funded project, supports research and knowledge sharing between participating countries to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources.

The programme is currently active in Ethiopia, Kenya, Ghana, Malawi, Mozambique, Tanzania, Zambia, South Africa, Democratic Republic of Congo and South Sudan and is developing relationships with a number of other countries and regional organisations across Africa.

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Appendices

ABBREVIATIONS & ACRONYMS

AFCAP	African Community Access Programme
CD	Compact Disc
CRRR	Climate Resilient Rural Road
DfID	Department for International Development
DVD	
EDCs	Economically emerging and Developing Countries
EOD	Environmentally Optimised Design
esa	equivalent standard axle
gTKP	Global Transport Knowledge Partnership
Km	kilometre
LCPG	Low Cost Surfacing and Pavement Guideline
LCS	Low Cost Surfacing
LVRR	Low Volume Rural Road
LVSR	Low Volume Sealed Roads
RRSR	Rural Road Surfacing Research
RRST	Rural Road Surfacing Trials
RT3	Rural Transport 3 Project (Vietnam)
SADC	South African Development Community
SEACAP	South East Asia Community Access Programme
ToR	Terms of Reference
WLC	Whole Life Costs

1 INTRODUCTION

1.1 Context

It is an established maxim that effective transportation plays a crucial role in rural socio-economic development and in reducing poverty. The common situation in most less developed countries is one of a large rural population with agricultural-based economies where the imperative is to provide rural communities with safe and sustainable access to basic services, opportunities and markets. In these countries, a high percentage of the rural road network generally remains unpaved with traditional road building materials often scarce or available only at high cost and frequently accompanied by poor quality construction control and very poor maintenance. It is increasingly important to encourage further development of rural road networks in an affordable and sustainable way, by efficiently utilising local resources to provide low cost transport and access to health, education, knowledge, services and markets to help reduce poverty.

During the past 20 years or so, DfID and other development agencies have supported research and knowledge transfer on various aspects of rural infrastructure specifically with the aim of reducing costs and increasing the effectiveness of the provision of roads for rural and peri-urban communities. Much of this targeted research has been highly successful, resulting in innovative and unconventional approaches that can provide highly beneficial and cost effective solutions for LVRRs in these countries through, for example, the use of alternative sustainable road surfacings. In this context, LVRRs are generally categorised as carrying less than the equivalent of 300 number 2-axle motor vehicles per day (or approximately 1 million esas in pavement design life).

Many of the recently researched surfacing and paving options can make better use of local resources, such as local or even marginal materials, local labour, and can be suitable for construction by locally based small scale contractors with limited capital and equipment. These attributes offer potential for lower costs with the added benefit of positive contributions to local social and economic development and self-sufficiency.

DfID, World Bank and Asian Development Bank funded research under the South East Asia Community Access Programme (SEACAP) has developed a considerable amount of knowledge on LVRR paving and surfacing techniques suitable for application in resource constrained conditions, whilst multi-agency supported research in the Southern Africa region enabled a Low Volume Sealed Roads Guideline (The SADC LVSR Guideline) to be developed. In addition AFCAP is currently supporting LVRR research and development in a number of sub-Saharan counties

It is clear that undertaking research and developing likely solutions is not nearly enough. There has to be a framework within which they can be mainstreamed. There is, therefore, a need to compile and synthesise the recently acquired LVRR knowledge into a concise international Low-Cost Road Surfacing and Pavement Guideline (LCPG) that would impart confidence in these methods and aid rural road practitioners in the development and implementation of local “good-practice” pavement and surfacing designs and construction procedures within a framework of national standards and specifications that best suit local conditions within individual countries or regions.

1.2 Background

The Global Transport Knowledge Partnership (gTKP) had already supported the production of the Small Structures for Rural Roads Guideline, and the development of a complementary guideline on surfacings and pavements for LVRRs was a logical initiative, particularly in the light of recent research outputs from SADC, SEACAP and experience beginning to flow from the current AFCAP

programme. Under DfID funding for gTKP, the Phase 1 of the preparation of the LCPG was carried out in 2009-2010 by OTB Engineering in association with TRL.

1.3 Report Objectives

This Inception Report relates to Phase 2 of the LCPG programme and serves to summarise the project status and highlight the changes in assumptions regarding LCPG since the completion of the Phase 1 Report in August 2010, and the necessary refinements to the approach to complete the Guideline.

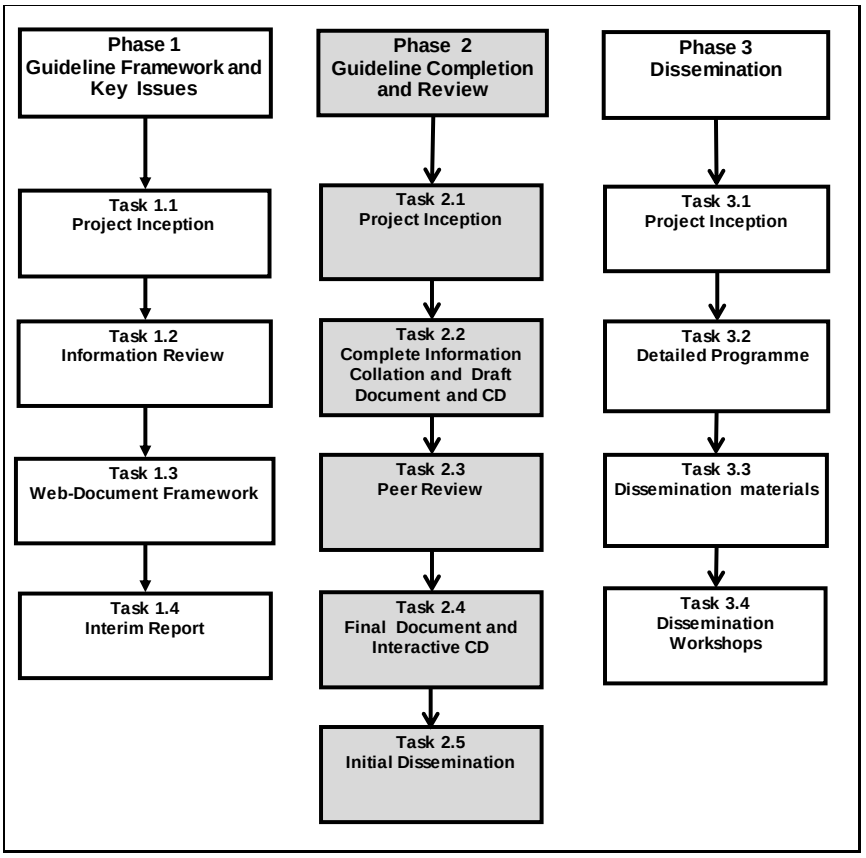
This Report describes activities in the inception period of Phase 2, presents the completion programme and identifies further sources of reference material to be used in the completion of the LCPG.

2 PROJECT OUTLINE

2.1 Project Aims

The original objective of the overall project was to develop a web-postable version of a Low Cost Road Surface Guideline and initiate a knowledge dissemination programme. It was subsequently decided to extend the title to clearly convey the scope intended to include the underlying pavement layers in a single comprehensive guideline: Low Cost Road Surfacing and Pavement Guideline (LCPG). The overall programme was intended to comprise three separate, but linked, phases (Figure.1)

Figure 1 Overall LCPG Programme



The objective of this particular Phase 2 consultancy is to complete a web-friendly or electronically interactive version of the LCPG and initiate a knowledge dissemination programme.

The guideline will encompass the lessons from the design, construction, supervision and monitoring of a range of surface and paving types trialled and investigated in the Cambodia, Laos and Vietnam SEACAP projects and their subsequent World Bank funded extensions, together with the knowledge compiled in the SADC Guideline, and other relevant programmes, including recent AFCAP initiatives. Its scope will range from Engineered Natural Surface (earth road), through gravel to various unbound, natural stone, bituminous, cement-based and clay brick surfacing and pavement layers.

The principal final output will be an electronic interactive version of a Low-Cost Road Surfacing and Pavement Guideline produced in MS WORD.

2.2 Project Status

Phase 1 was completed in December 2010 and included the following outputs:

1. Inception Report
2. Interim Report
3. Phase 1 Completion Report
4. Interim Guideline Document

The Phase 1 Completion Report summarised the status of the Interim LCPG as follows

Section 1: Introduction	1st Draft complete
Section 2 Guideline Framework	1st Draft complete
Section 3 Key Issues	Draft substantially complete
Section 4 Project Identification	Headings and key tables
Section 5 Feasibility Studies	Headings and key tables
Section 6 Engineering Design	Headings and key tables
Section 7 Construction	Headings and key tables
Section 8.Maintenance	Headings and key tables
Section 9 Rehabilitation/Upgrade	Headings and key tables
Annex A. Surfacing and Pavement Options	Draft substantially complete
Annex B. Key Procedure Links	Tables outlined
Annex C. Bibliography	1st Draft complete

2.3 Scope of Work – Phase 2

The Terms of Reference (Appendix A) summarised the Scope of Works for Phase 2 of the Project by stating that the consultant should define and discuss the key principles associated with the following:

- Use of local resources: (materials, labour, skills, locally based enterprises etc.)
- Definition of road task; (required access; traffic needs; poverty reduction etc.)
- Environmentally Optimised Design including Spot Improvement strategies
- Maintenance arrangements and capacity
- Life Cycle Costing
- Surface and pavement options
- Design approach and guidelines

- Construction and supervision issues
- Appropriate Standards
- Relevant Technical Specifications.

2.4 Contractual Arrangements

A Technical and Financial Proposal for LCPG Phase 2 was submitted to AFCAP by OTB Engineering UK LLP (OtB) in January 2012. Following this, AFCAP, through the programme managers, Crown Agents for Overseas Governments and Administrations Ltd, issued a contract to OtB, which was signed on 23rd May 2012. OTB Engineering LLP subsequently entered into arrangements with Intech Asset Management for the supply of the professional services of Rob Petts and with Dr John Rolt for his services in an advisory and review capacity.

3 INCEPTION ACTIVITIES

3.1 Work Undertaken

The following key activities have taken place during the inception period:

- Review of Status and Strategy
- Modification to Project Approach
- Source Document Review
- Presentation Abstract
- Drafting of Inception Report

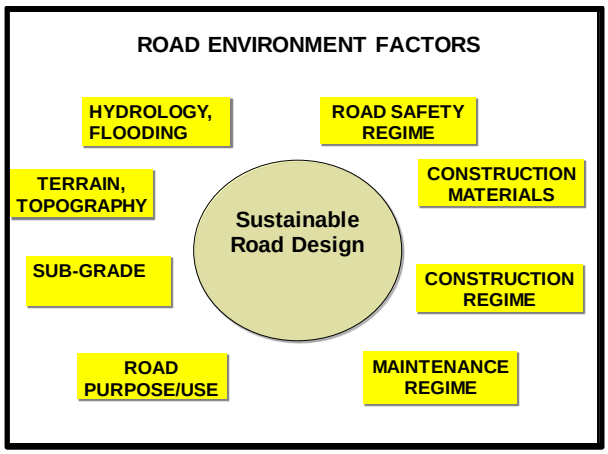
3.2 Review of Status and Strategy

A review of the status and strategy of the project has been undertaken by the Project Team that took into account developments within the LVRR research and development environment since completion of Phase 1 in December 2010. In addition, Rob Petts took the opportunity during his visit to the recent AFCAP Meeting in Maputo to informally discuss progress of relevant AFCAP projects.

The principal underlying strategic message remains true for Phase 2 of the project, namely that one clear output to emerge from rural infrastructure research over the last 20 years is that the performance of LVRR pavements is greatly influenced by local conditions, or what has become known as the local Road Environment. If this is accepted then it is logical to assume that to attempt to draft an overall, global, detailed guide to good practice for LVRR pavements is not a sensible approach. Therefore, the overall strategy adopted, within the current project constraints, for the LCPG document is to draft a clear and practical framework that may be used by road asset managers and practitioners for the development of best practice linked to regional or national standards, specification and designs. This approach involves defining key principles and indicating how these principles may be beneficially incorporated into locally focussed designs. The key principals remain that LVRRS should be

- **Task based;** roads must suit their identified function and the traffic (the people as well as the vehicles) which will pass along them.
- **Environmentally compatible**; suitable for, and if necessary adapted to, the local environment taking account of the factors illustrated in Figure 2.

Figure 2 Road Environment Factors



- **Local resource based**; road design guidance must be compatible with the construction materials that are readily available, within the capacities of the engineers and technicians who will the design the roads and the contractors and labourers who will construct them, and the villagers or local organisations who maintain them.
- **Financially sustainable;** the guidance must facilitate the construction of roads with whole life asset costs that will not overwhelm the national or local authority budgets or place excessive maintenance burdens on local communities.
- **Have an Adaptable Design;** where available resources are not sufficient to fund complete route upgrades to optimal economic whole life cost surface standards, Environmentally Optimised Design (EOD) guidance will be provided on basic access, spot improvement and differential surface strategies within a particular route.

3.3 Revision to Original Web-Linked Approach

An important assumption in the LCPG concept was the availability of an actively managed website knowledge portal as the key document source and home for the reference database. Document users were to be guided towards relevant detailed advice within the gTKP web-accessible electronic library. Where key documents were not already within the gTKP library, these would be signposted. Unfortunately, the subsequent withdrawal of DfID support for gTKP and the loss of an actively managed knowledge portal have meant that this aspect of the LCPG dissemination strategy needed to be reviewed. It is understood that DfID are investigating the possible establishment of a permanent transport knowledge portal in response to the request by the UK Parliamentary Select Committee (Infrastructure and Development) that past DfID and other related research generated knowledge should be more easily accessible. However, at the moment this portal is not yet in existence and no other website is either suitable or available.

On consideration it is considered that the best current option is to include all of the current reference documents on a CD/DVD and for them to be electronically linked to an electronic version of the LCPG on the same disc.

3.4 Document Review

Additional documents have been identified and included within the LCPG reference database; an updated listing is included as Appendix B to this report. Document evaluation is in progress for relevant information, with the focus being on utilising documents that may be readily accessed by LCPG users, within the constraints of international copyright and intellectual property rights.

3.5 Dissemination Opportunities

The 6th Africa Transportation Technology Transfer (T2) Conference has been identified as a potential initial dissemination opportunity; the following abstract has been submitted:

The International Low Cost Road Surfacing and Pavement Guideline
Dr J R Cook (OTB Engineering UK LLP)
R C Petts (Intech Asset Management, UK)

The full abstract is included as Appendix C to this report

4 POST-INCEPTION PROJECT TASKS

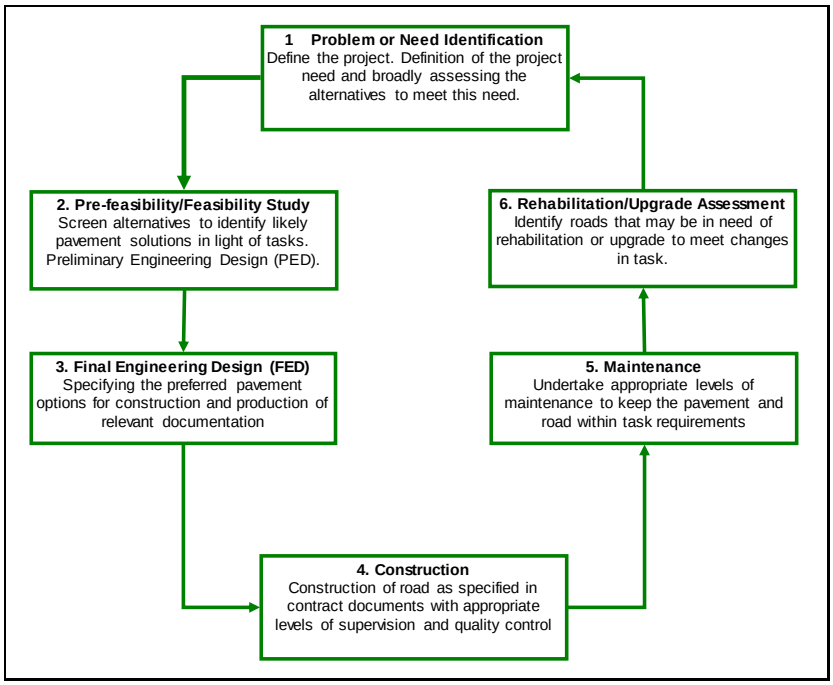
4.1 Completion of LCPG Draft Document

Key tasks have been identified as:

1. Review of recent S E Asian and AFCAP data:
   Since 2010 additional work has been undertaken on the SEACAP trial sites in terms of monitoring and data analysis. In addition the World Bank has focused attention on these and more recent trials (SEACAP 30's extension), particularly with respect to Climate Resilience. In fact in the past two years throughout S E Asia and South Asia there has been increased attention given to the development of guidance on sustainable Climate Resilient Roads (CRRs). Outcomes from this work will be included in the LCPG document. Although there has not yet been time for meaningful monitoring data to emerge from the AFCAP projects, there has still been a significant amount of interim reporting which will be reviewed for possible inclusion in the LCPG

2. Completion Guideline Sections.
   Within the established framework the guideline sections will take account of, and provide appropriate advice, on, a number of key topics pertinent to the development of country or region-specific LVRR pavement best practice designs. It is intended that the LCPG in its final format will provide comprehensive guidance on the development of local LVRR designs by highlighting key issues; by providing comment on how these issues may be addressed; and indicating accessible sources of relevant information and examples. The nature of the guidance will also take into account the level of user responsibilities within the Asset Life Cycle (Figure 3) as amended from ORN 5 (TRL, 2005).

Figure .3 The LVRR Asset Life Cycle



3. Develop electronic reference links.
   It is intended that key references, where legally permitted, will be electronically linked to the relevant text in the CD version of the LCPG.

4. Draft User Guide.
   A short executive user guide to the LCPG and related references and reference database will be drafted.

4.2 Peer Review

Key tasks have been identified as

1. External review.
   Dr John Rolt will undertake an internal technical review for OtB (see section 5.2 below), however, it is understood that an additional externally funded and independent peer reviewer may be identified by the Client.

2. Collate Peer Review Comments.
   Internal and external peer review comments will be discussed and where agreed with by the Client will be included in the final LCPG document

4.3 Final Document

Key tasks have been identified as:

1. Include agreed comments in Guideline
2. Final edit of all text and figures
3. Edit all reference links

4. Prepare print-ready document

4.4 Initial Dissemination

The following actions were originally identified at project proposal stage in January 2012:

1. Identify dissemination links
2. Link to broader AFCAP dissemination programme
3. Drafting of dissemination materials
4. Presentation at AFCAP Workshop (2012)
5. Identify further dissemination programme

These actions need now to be re-evaluated within the AFCAP programme as it now stands and in the light of any additional AFCAP dissemination work. As noted in Section 3.5, an abstract has been submitted to The 6th Africa Transportation Technology Transfer (T2) Conference in March2013. If accepted, this would be an ideal opportunity to roll out the completed LCPG. This, however, would be subject to agreement by the Client for an extension of programme beyond December 2012.

In addition contact has been established with the International Association of Engineering Geology and the Environment (IAEG). IAEG has recently established a research Commission (C32) on "Engineering Geology and Rural Infrastructure" under the chairmanship of Dr Cook, with the following objective:

> *To promote the increased involvement of engineering geology in the appropriate design, construction and maintenance of sustainable rural infrastructure within developing countries and hence contribute to the alleviation of rural poverty*

Links with IAEG would be beneficial for disseminating the LCPG to a wider audience as one of the stated actions of this Committee is to develop and maintain a part of the IAEG web site as a repository of relevant documents and establish links to other appropriate sites and sources of information.

4.5 Further Project Development

The present contract includes programmes and tasks for Phase 2 of the overall project in which initial plans will be outlined for the important 'roll out' of dissemination and mainstreaming activities envisaged for development under Phase 3.

Phase 3 is expected to involve other sector stakeholders interested in supporting the achievement of the real benefits of adaption of national standards, specifications and procedures based on good practice and guidance provided in the LCPG.

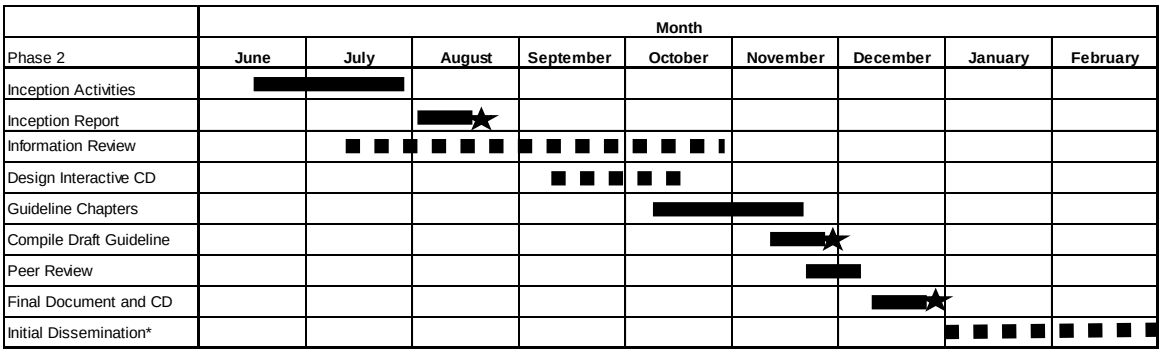
5 PROJECT PLANNING

5.1 Programme

The outline programme for completing Phase 2 of the LRSG is presented as Figure 3.

Programming of the follow-on Phase 3 is a function of funding and contractual issues that are outside the scope of the current contract.

Figure 4 Phase 2 Programme



*Note that dissemination activities, if undertaken, will require a run through into early 2013

5.2 Human Resources

The principal human resources to cover the technical aspects of the project are summarised in the following Table 1

Table 1 Project Human Resources

Name	Designation	Input Days		Activity
		Document	Dissemination	
Dr J R Cook	Team Leader	40	10	Responsible for organisation and management of the Team and its technical output. Principal Collating Author for the document and any agreed dissemination papers.
R C Petts	Principal Researcher	15	5	Responsible for drafting key sections of the document including Whole-Life Costing, Maintenance and Alternative surfacing Option issues.
Dr J Rolt	Internal Technical Quality Reviewer	10	2	Responsible for internal reviewing completed sections of the document as well as providing key input into Pavement Design and Bituminous Surfacing , as well as contributing sections on recent AFCAP outputs .
T Booker	IT Specialist	13	0	Responsible for all IT aspects of the project and particular developing the format of the reference linkages in the stand-alone CD

Appendix A
Terms of Reference
Completion of The Low Cost Road Surfacing and Pavement Guideline Document based on SEACAP to include AFCAP and bring the output into AFCAP

Background

.

The Global Transport Knowledge Partnership (gTKP) supported the production of the Low Cost Structures Manual and the development of a parallel guideline on surfacings and pavements for LVRRs was a logical initiative, particularly in the light of recent research outputs from SADC, SEACAP and the current AFCAP programme. Consequently, following preliminary discussions, gTKP issued a Works Order for an initial phase of the development of a web-based Low Cost Roads Surfacing Guideline to OTB Engineering Ltd on 14th December 2009. The objective of the project was to develop a web postable version of a Low Cost Road Surface Guideline and initiate a knowledge dissemination programme. It was subsequently decided to extend the title to clearly convey the scope intended to include the underlying pavement layers in a comprehensive guideline: Low Cost Road Surfacing and Pavement Guideline.

The project was partially completed under gTKP however when DFID funding to gTKP was stopped the project was left incomplete.

Output:

Guidelines suitable for printing in a hard bound copy and mounting on a CD or DVD that are readable through Microsoft Internet Explorer and other common proprietary web browsers. To include electronic copies of the referenced documents where permissible under international distribution licenses, Intellectual Property and copyright legislation.

Objective

The guideline will encompass the lessons learnt from the design, construction, supervision and monitoring of a range of surface and paving types trialled and analysed in SEACAP, AFCAP and knowledge compiled in the SADC Guideline.

The guideline will contain detailed guidance and flow charts leading users through decision processes referencing key and supporting texts with necessary supporting data and examples. It will highlight the strengths, and weaknesses of the approaches with possible alternatives listed and provide points for consideration regarding the environmental, social, health and safety impact of the differing approaches (it is recognised that this is an engineering guideline however the influence on and the wider impact of engineering decisions needs to be highlighted) Its scope will range from Engineered Natural Surface (earth road), through gravel to the various unbound, natural stone, bituminous, cement based and clay brick surfacing and pavement layers. The various surfacing and paving techniques can be adapted to local application in Africa, Asia and elsewhere by careful consideration of the local resources and environment, as guided by the LCPG.

The guideline will define and discuss the key principles associated with the following:

- Use of local resources: (materials, labour, skills, locally based enterprises etc.)
- Definition of road task; (required access; traffic needs; poverty reduction etc.)

- Environmentally Optimised Design including Spot Improvement strategies
- Maintenance arrangements and capacity
- Life Cycle Costing
- Surface and pavement options
- Design approach and guidelines
- Construction and supervision issues
- Appropriate Standards
- Relevant Technical Specifications

Appendix B
Revised Reference List

Author	Year	Title
AASHTO	2008	Mechanistic -empirical pavement design guide: A manual of practice. AASHTO, Washington.
AASHTO	1962	The AASHTO road test: Pavement research. Special Report 61E. ASSHTO. Special Report 61E. ASSHTO
ADB	2001	Safe planning and design of roads. Road safety guidelines 4.4. ADB, Phillipines
ADB	1998	Vulnerable road users in the ASEAN and Pacific region. ADB Phillipines.
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Al-Fayadh S.	2001	Pavement Option Series 1: Labour based stone paved roads. ILO for MRD, Cambodia
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Andreski A., Seth S. & Walker W.	2006	How a road agency can transform from force account road maintenance to contracting. WB Transport paper TP-11
Archanodo-Callao	1999	Roads Economic Decision (RED) model for economic evaluation of low volume roads. Africa Transport Technical Note; SSATP 18
Archondo-Callao R.S	1999	Unpaved roads' roughness estimation by subjective evaluation. WB Infrastructure Notes RT 2
Archondo-Callao R.S	1999	Typical unpaved roads roughness predicted by the HDM III model. WB Infrastructure Notes, RT 1.
Archondo-Callao R.S.	1999	Paving of unpaved roads, economically justified paving costs. WB Infrastructure Notes RT 3
ARRB	2000	Unsealed roads manual: Guideline to good practice. ARRB Transport Research Ltd., Australia.
Austroads	1998	Guide to stabilisation in roadsworks. Austroads AP-60/98.
AUSTSTAB	2006	Interim pavement design guide for a cement stabilised base layer for light traffic. National Auststab Guideline
Beavan P.J	1971	Coral and other soft limestone in road building. TRL Overseas Bulletin No. 15. TRL Ltd, Crowthorne Berkshire.
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British Standards Institution	1990	BS 1377: Methods of Test for Soil for Civil Engineering. British Standards Institution
Broch E. & Franklin J.A.	1972	The point load strength test. Int. Jnl. Rock Mech. Min. Sci.
Charman J.M. (ed)	1988	Laterite in road pavements. CIRIA Spec. Pub. No.47, London.

CIDB	2007	Implementing employment intensive road works; Manual 3, gravel pavement layers. Construction Industry Development Board, South Africa.
CIDB	2005	Labour-based methods and technologies for employment intensive construction works. Construction Industry Development Board, South Africa.
CIDB	2007	Implementing employment intensive road works, Manual 4: Bituminous Pavement Seals. Construction Industry Development Board, South Africa.
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Cook J.R.	2009	The rural road surfacing research (RRSR) database: SEACAP 27 Technical Report 2; A summary of structure and content. Report to DfID to MoT, Vietnam.
Cook J.R. & Bounta Meksavanh	2009	Performance monitoring of low volume rural roads in Northwest Lao PDR. SEACAP 17.02 DfID for MPWT
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Cook J.R. & Younger J.S.	1994	The impact of the characteristics of Indonesian soils on construction. Proc. 13th Int. Conf. SMFE, New Delhi.
Cook J.R.& Kackada H.	2008	Low volume road upgrade options. SEACAP 19 Technical Paper 4. DfID report for MRD, MPWT Cambodia.
Cook J.R., Dzung B.T. & Bennet R.	2009	Pavement trials design, Rural Transport Programme 3; SEACAP 30 Technical Paper. For DfID and MoT Vietnam.
Cook J.R., Gourley C. & Elsworth N.E.	2001	The selection and use of construction materials for road construction in tropical and sub-tropical countries. DfID KaR Report R6898, TRL Ltd, UK.
Cook J.R., Rolt J., Dzung B.T. & Tuan P.G.	2008	A case study of the premature failure of a trial road in Dak Lak province Vietnam. Paper for DfID and SEACAP
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Emery S.J., van Huysteen S. & van Zyl G.D.	1991	Appropriate standards for effective bituminous surfacings. CSIR Transportek Report. Pretoria.

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Geol. Soc.	1977	The description of rock masses for engineering purposes: Working Party Report. QJEG
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Gourley C. & Greening P.A.K.	1999	Performances of low-volume sealed roads; results and recommendations from studies in southern Africa. TRL Published Report PR/OSC/167/99.
Gourley C.S. & Greening P. A. K.	1996	Performance of chemically stabilised roadbases: results and recommendations from studies in southern Africa. TRL Project Report PR/OSC/168/99.

Gourley C.S. & Greening P.A.K.	1999	Environmental damage from extraction of road building materials: Results and recommendations from studies in Southern Africa. TRL Report PR/OSC/169/99 for DfID, UK
Gourley C.S., Toole T., Morosiuk G., & Hine J.	2001	Cost effective designs for low volume sealed roads in tropical and sub-tropical countries. TRL Project Report S00240
Gov. of Malawi	2004	Manual for designing rural roads, tracks and paths. MLGRD, MTPW, Malawi.
Gov. Of Malawi	2004	Overview of rural transport infrastructure. MLGRD, MTPW, Malawi.
Gov. of Malawi.	2004	Planning guideline for rural transport infrastructure. MLGRD, MTPW, Malawi.
Gov. Of Zimbabwe	1998	A pocket guide to road design of low volume roads. MoPW, Zimbabwe.
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Appendix C
Initial Dissemination

6th Africa Transportation Technology Transfer (T2) Conference

ABSTRACT

The International Low Cost Road Surfacing and Pavement Guideline

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During the past 20 years, the Department of International Development (DfID), the World Bank and other donors and partner governments have supported research and knowledge transfer on various aspects of rural infrastructure. Recent key programmes include

- The South East Asia Community Access Programme (SEACAP)
- The African Community Access Programme (AFCAP)
- The SADC Low-Volume Sealed Roads Guidelines Project.

Much of this targeted research has been highly successful, resulting in innovative and unconventional approaches that can provide highly beneficial and cost effective solutions for low volume roads with potential consequential improvement in rural access and alleviation of poverty. However, the transition from successful research to the mainstreaming of innovative technology is often a difficult process; barriers to knowledge mainstreaming remain a major challenge to the transport sector. There is a recognised need to compile and synthesise recently acquired LVRR knowledge so as to aid rural road practitioners in the development and implementation of local "good-practice" designs and construction procedures within a framework of standards and specifications that best suit conditions within individual countries or regions. To this end DfID have funded the completion of an international Low-Cost Road Surface and Pavement Guideline that combines recent and S E Asian and African research into a comprehensive document to promote more effective knowledge transfer in the rural transport sector and increase the capacity of less developed countries to access and apply good practice.

One of the fundamental principles behind recent pavement research output has been the requirement for locally orientated solutions based on available local resources and the local road environment. This approach is seen as crucial in the development of affordable and sustainable rural infrastructure. It follows, therefore, that a good practice pavement guideline should also be aimed at local application. However, a comprehensive document covering all developing country regions would either be very cumbersome or too inflexible for practical use. The approach adopted by the Low-Cost Road Surface and Pavement Guideline document of providing general guidance within an overall framework linked to key references was seen as the best approach for the development and application of locally relevant good practice. The adoption of a web-postable strategy was seen as adding important elements of increased flexibility and easier access. In a dynamic research environment the approach also allows regular review and update.

This paper summarises the key points arising out recent African and S E Asian research that are contained within the completed Low-Cost Road Surface and Pavement Guideline and indicates its appropriate application in the dissemination of good practice in LVRR development.

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