

**Sixth Regional Seminar for Labour-based Practitioners**

**Ministry of Works, Transport and Communication, Uganda  
in collaboration with ASIST**

**Jinja, Uganda  
29th September - 3rd October 1997**

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# **Labour-based Technology A Review of Current Practice**

PROCEEDINGS OF THE SIXTH REGIONAL SEMINAR

*Theme of the seminar:*

***The Right Tool for the Job — A Review of Tools and  
Equipment for Labour-based Infrastructure Works***

**Compiled by**

*Sam Emorut-Erongut*

***Edited by***

*Angela Kabiru-Kangethe, David Mason and Gamalilhe Sibanda*



**International Labour Organisation**

**Advisory Support, Information Services and Training (ASIST)  
Nairobi, Kenya**

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## Abbreviations and acronyms

4WD	Four Wheel Drive
ADT	Average Daily Traffic
ASIST	Advisory Support, Information Services and Training
CBR	California Bearing Ratio
CSIR	Council for Scientific and Industrial Research
DA	District Administration
DANIDA	Danish International Development Agency
DCP	Dynamic Cone Penetrometer
DEP	Provincial Department of Roads
DFID	Department for International Development
DFR	Department of Feeder Roads
DNEP	Mozambique National Directorate of Roads and Bridges
EIP	Employment Intensive Programme
ETB	Emulsion Treated Base
FIT	Farm Implements and Tools
FUR	Fixed Unit Rate
GoU	Government of Uganda
GRZ	Government of the Republic of Zambia
HP	Horsepower
IAPSO	UN Procurement Agency
KIHABT	Kenya Institute of Highways and Building Technology
ILO	International Labour Organisation
MART	Management of Appropriate Road Technology
MoLG	Ministry of Local Government
MoLGH	Ministry of Local Government and Housing
MoPWH	Ministry of Public Works and Housing
MoWTC	Ministry of Works, Transport and Communication
MPED	Ministry of Planning and Economic Development
MSE	Micro-and small scale enterprises
NDF	Nordic Development Fund
NGO	Non Governmental Organisation
ODA	Overseas Development Agency



## Abbreviations and acronyms (continued)

RCCD	Rapid Compaction Control Device
RFR	Rural Feeder Roads
SFD	Social Fund for Development
SWARP	South West Agricultural Project
ULI	User Led Innovation
UN	United Nations
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
UTRP	Uganda Transport Rehabilitation Project
VAT	Value Added Tax
WB	World Bank
WLF	World Lutheran Federation



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# 1 Introduction

## 1.1 BACKGROUND TO THE SEMINAR

The Sixth Regional Seminar for Labour-Based Practitioners in Sub-Saharan Africa took place over a five-day period, from 29 September to 3 October 1997, in Jinja, Uganda. It was jointly organised by the Ministry of Works Transport and Communications (MoWTC), the Ministry of Local Government (MoLG) and the Ministry of Planning and Economic Development (MPED) of the Uganda Government, in partnership with the ILO/ASIST programme. The theme of the workshop was **The right tool for the job — A review of tools and equipment for labour-based infrastructure works.**

The seminar was the sixth in a series of reviews of current practices in labour-based technology. Previous seminars have been held in the following countries:

- 1st Mbeya, Tanzania, 26 - 28 February 1990  
Topics covered: low cost structures, haulage, training, road maintenance, labour management
- 2nd Mophale's Hoek, Lesotho, 2 - 6 March 1992  
Topics covered: road maintenance, contracting, compaction, labour standards
- 3rd Harare, Zimbabwe, 27 September - 1 October 1993  
Topics covered: tools and equipment, small-scale contractor development, involvement of women in labour-based roadworks, ASIST Technical Enquiry Service
- 4th Johannesburg, South Africa, 16 - 20 January 1995  
Theme: urban infrastructure development, education and training
- 5th Accra, Ghana, 22 - 26 April 1996  
Theme: labour-based contracting.

The present seminar provided a forum for the stakeholders in labour-based infrastructure works in Sub-Saharan Africa to discuss and share experiences. The wealth of experience shared, the new ideas and innovations presented, the discussion of problems and how various programmes and countries are tackling them – all made for a useful learning-teaching interaction between participants. This interaction is expected to stimulate further debate and possibly solutions to some of the problems encountered in the applications of labour-based technology. At the end of the day, the process should lead to further development as well as to the diffusion of new ideas. This in turn may result in the deployment of improved, effective and efficient labour-based techniques in infrastructure works. The Sixth Regional Seminar





advocated the extension of labour-based practices and technology beyond the roads sector, where the emphasis has been in the past, to other sectors dealing with civil works.

## 1.2 STRUCTURE OF THE REPORT

The proceedings of the seminar are documented in two separate volumes:

***Volume I: Labour-based Technology — A Review of Current Practice. Proceedings of the Sixth Regional Seminar.***

This volume contains a summary of the papers presented and of the discussions that followed. This report is structured as follows: Chapter 1 gives the background of the seminar. Chapter 2 gives the seminar objectives, methodology and a summary of the evaluation. Chapter 3 presents a summary of the papers presented during the initial scene setting of the seminar. In Chapter 4, summaries of all the papers presented are provided followed by the discussion highlights. Chapter 5 presents the full text of discussions arising from each presentation. Chapter 6 reports on the field visit. Chapter 7 comprises a presentation of the statements of the seminar.

The seminar agenda, opening and closing speeches, and lists of moderators and participants, are all provided in the annexes.

This volume is supplied free of charge to all registered seminar participants.

***Volume II: Labour-based Technology — A Review of Current Practice. Papers of the Sixth Regional Seminar.*** This provides the full text of all papers, both of those presented as well as those circulated. Volume II can be ordered from ILO/ASIST or from the Development Policies Branch of the ILO in Geneva.



## 2 Seminar proceedings

### 2.1 SEMINAR OBJECTIVES

The seminar's objectives were:

- To bring together practitioners in labour-based and employment-intensive infrastructure works and thus enable them to exchange experiences.
- To update participants on employment-intensive policies and programmes in Sub-Saharan Africa.
- To broaden participants' horizons to include urban infrastructure works and rural travel and transport, including the issue of accessibility planning.
- To obtain feedback from participants on what services they want ILO/ASIST to provide.
- To identify and debate key issues relating to tools and equipment for labour-based infrastructure.

The first two objectives were common to all regional seminars; the last three were specific to this seminar.

### 2.2 METHODOLOGY

#### 2.2.1 Plenary sessions

Papers were presented by experts from around the region and outside it covering a range of issues related to tools and equipment. Following paper presentation a panel of experts, selected from the participants, commented on and responded to issues raised in the presentation, after which the debate or discussion was open to the floor. Most presentations included the use of visual aids such as transparencies, slide shows, demonstrations, or a combination of one or more aids. The time allotted for each presentation was approximately 45 minutes; however, some topics tended to generate more discussion than others and went on longer. In all, a total of 19 papers was presented.

#### 2.2.2 Field visit

On the third day, participants visited the project area of the Uganda Transport Rehabilitation Project (UTRP) in Mbale, Eastern Uganda, some 200km from the seminar venue. Three sites were visited, including two contractor-managed roadworks sites, and the Training Centre where there was an exhibition of various tools and equipment.



## 2.3 SEMINAR PARTICIPANTS

The seminar attracted a total of 115 participants from government ministries, non-governmental organisations, research institutions, universities, consultants and manufacturers. A total of 17 countries was represented: Botswana, Egypt, Eritrea, Ethiopia, Ghana, Kenya, Lesotho, Mozambique, Namibia, South Africa, Swaziland, Switzerland, Tanzania, Uganda, United Kingdom, Zambia, and Zimbabwe. Participants from Egypt and Eritrea attended for the first time. The names, organisations and addresses of the participants are to be found in Annex 6.

## 2.4 EVALUATION

The seminar was evaluated by means of a written questionnaire, which was completed by 83 out of 117 participants. The assessment of the objectives was done in a plenary session on the last day of the workshop.

Most people felt that the seminar met the objective of bringing together practitioners and discussing key issues. However, participants felt that the objective of updating them on employment intensive programmes could have been covered in greater depth.

The seminar presentation and methodology were rated as fair to good, though it was noted that some presenters digressed from the seminar theme. Some participants felt that a greater use of groupwork would have enhanced the learning process. About 20 per cent of the participants noted that, due to the large number of papers, there was limited time for discussion. Most participants affirmed that the number of participants attending the seminar and the duration was appropriate.

The field visit was found to be very interesting, but the time allocated to the visit was considered to be too short. This was partly the result of the delay in providing transport at the beginning of the trip. Furthermore the large number of participants made it difficult to actively involve all of them during the visit. It was therefore recommended to organise two alternative study tours during the next Regional Seminar.

Most participants rated the seminar organisation as good. The venue, secretariat, registration, publications and display of information were highly appreciated. Transport management was performed fairly well, but participants were disappointed with the transport arrangements during the field visit. Transport to the site received the lowest average rating of 2.4 out of 5.

Due to the lack of large hotels in Jinja, participants were accommodated at six different hotels. Hotels scored a low average rate of 2.5 out of 5. However the services rendered by the hotels was fair, considering that Jinja town is small and has a strong rural background. The hotels managed to provide basic services to 117 persons at affordable rates.



The majority of participants selected Zambia as their preferred venue for the next seminar; the theme suggested was contractor development.

See Annex 5 for questionnaire analysis charts.

## **2.5 ACKNOWLEDGEMENTS**

The ILO/ASIST seminar secretariat wishes to express its thanks to the Government of Uganda for hosting the seminar. MoWTC, MoLG and MPED are especially thanked for their role in organising and co-ordinating the seminar. ILO/ASIST is also grateful to the Minister of State for Local Government, the Hon. Awuzu Andraule, for opening the seminar; and to the Minister of State for Works, Transport and Communications, the Hon. Wanjuzi-Wasieba, for closing the seminar. The full texts of the opening and closing speeches are in Annexes 2 and 3 respectively.

Last but not least, special thanks are given to all presenters, panellists and participants, for their contributions and attendance.



### 3 Scene setting

To set the scene, presentations of the objectives and agenda of the seminar were given. Presentations of the ILO's employment intensive programme and of the role of the ASIST programme in promoting and developing labour-based technology followed. This chapter provides a summary of the presentations.

#### 3.1 THE ILO AND EMPLOYMENT-INTENSIVE INFRASTRUCTURE POLICIES AND PRACTICES

Jan de Veen, Development and Technical Co-operation Department, ILO, Geneva, Switzerland

The presentation provided an overview of the Employment Intensive Programme (EIP) and its relevance to labour-based works. The EIP was created in the mid 1970s as part of the ILO's response to the deteriorating employment situation in developing countries. It has progressively developed policies and practices in support of labour-based technologies in the infrastructure sector in participating developing countries. The paper discusses the EIP in the context of the Programme of Action adopted by the World Summit for Social Development, Copenhagen, 1995. This states that labour-intensive investments in infrastructure should be encouraged. It also lays emphasis on the key role of small and medium-sized private sector enterprises, whose creation and growth should be facilitated by improved access to credit, markets, training and technology.

The paper outlines the evolution of the EIP into a programme concerned with long-term sustainable development whose principal means of action is capacity building in both public and private sectors. By the end of 1996, 25 EIP Country Programmes were in operation, representing 70 different projects, of which eight were regional projects. These country projects "now provide excellent opportunities for creating a multi-disciplinary approach to job creation in collaboration with other ILO programmes dealing with vocational training, enterprise development and co-operatives".

The EIP responds to the needs of workers in the unorganised sectors and to the needs of the unemployed. It does this not only by enabling employment creation, but also by helping to establish domestic construction industry capacities among small enterprises using employment-intensive methods. At the community level, the EIP helps grassroots people organise themselves and negotiate for a greater share of and more control over national infrastructure investment resources. Other areas of involvement include development of university curricula to promote labour-based technologies and other training programmes geared towards worksite supervisors, community associations and public officials. The EIP is also involved in the ILO's work on the urban informal sector, women in development, the environment and co-operative development.



The EIP's principal partners include employers, workers organisations (both formal and informal), NGOs, government ministries and departments, and local and municipal authorities.

The future orientation of the EIP will be to strengthen relations with Labour Ministries and employers' and workers' organisations. This will be with a view to defining jointly how best the unorganised workers and small-scale employers can be served by existing national institutions. The potential for developing labour legislation models for non-organised workers will also be explored.

Another area will be the integration of ILO principles and standards into new training materials and guidelines aimed at the private sector, government agencies and donors. As the programme evolves, tasks such as the provision of technical support and training can be transferred or subcontracted to other partners. This will leave the ILO free to concentrate on ensuring that employment-intensive approaches are adopted on a nation-wide scale. EIP activities include: technical co-operation, policy, formulation of technical guidelines and strategies, carrying out studies, preparation of country specific papers, conducting seminars and developing and testing materials for training courses.

In the road sector, the EIP is involved in the development of labour-based road technology; the development of appropriate tools and equipment; the development of small scale contractors; and the development of under- and post graduate training modules on labour-based technology. The programme is involved in technical co-operation projects in 20 countries mainly within Africa. The EIP regional programme ASIST provides technical backstopping, information and training services for Sub-Saharan Africa. The ASIST programme mandate also covers rural transport and urban infrastructure works.

The rural transport component considers a wide range of transport interventions, including interventions on tracks and paths, intermediate means of transport and rural transport services to complement roads and motorised transport. An integrated rural accessibility planning methodology has been developed and tested, providing a planning tool for local-level planning of infrastructure investment and the production of development plans. The ILO's work on rural transport has led to the creation of the International Forum for Rural Transport and Development, a global networking and information disseminating forum for rural transport issues.

The EIP also collaborates with World Bank multi-sectoral public works and employment projects executed by non-governmental agencies to create employment through infrastructure works which are sub-contracted to the private sector. An issue of concern to the ILO has been the short-term perspective of this approach and the resulting general neglect of training, capacity building and sustainable employment promotion. The ILO therefore collaborates with the World Bank and other agencies in the establishment of a sub-regional initiative to provide technical assistance, training and advisory services.



The paper concludes with an assertion of the potential for the local manufacture of good quality tools and light equipment for labour-based road construction. It decries the tendency to underestimate the negative effects of poorly designed and bad quality tools and equipment on productivity and the end product. It stresses the importance of appropriate tender and procurement procedures and the significant benefits accrued in terms of productivity and durability from the use of the right tools for the job.

### **3.2 THE ROLE OF ASIST: PAST, PRESENT AND FUTURE**

Jane Tournée, ILO/ASIST, Harare, Zimbabwe

This presentation outlined the role of the Advisory Support Information Services and Training (ASIST) programme. This role was set in the context of the developments in labour-based technology and in relation to the theme of the seminar, tools and equipment.

Since the 1970s, the ILO has been involved in creating a technology and methodology specifically for the use of labour-intensive techniques in rural road construction. As the programmes developed, several problems emerged with regard to tools and equipment, with most hand tools being borrowed directly from the agricultural sector. In the past, labour-based practitioners have been faced with the unavailability of appropriate tools and equipment, and a lack of knowledge about appropriate and alternative plant. Innovations have taken place in isolation, with poor dissemination of project experiences

Several contributions towards solving the problems associated with tools are currently being realised. Some notable developments include the availability of specifications for hand tools, although challenges relating to production and procurement of hand tools still exist. Trailer designs and improved hitching systems have also been made available.

The future brings new challenges with the expansion of labour-based technology into new areas; with the use of labour-based contractors; and with the potential for the application of labour-based techniques to the provision of a wide range of infrastructural developments in both rural and urban areas, leading to a more multi-sectoral application of labour-based methods.

The future role of ASIST will be to respond to the changing needs for labour-based technology. ASIST III will continue providing advisory, information and training services in rural infrastructure (in particular roads), as well as in rural travel and transport, urban infrastructure, community based programmes, multi-sectoral applications of labour-based techniques, and involvement of the private sector.

ASIST continues to gather and disseminate information through the Technical Enquiry Service, and to stimulate information sharing and exchange.



## 4 Summary of papers presented

### 4.1 LABOUR-BASED PROGRAMME — UGANDA COUNTRY PAPER

Eng. W E Musumba, Ministry of Works Transport and Communication, Uganda

Under the Road Maintenance Initiative, the Government of Uganda has adopted a deliberate policy of increasing the use of labour-based contractors for roadworks, and promoting the development of a local contracting industry. This paper describes the government's highway network policy and various labour-based programmes involving small scale contractors under the Ministry of Works Transport and Communications, the Ministry of Local Government and the Ministry of Planning and Economic Development. The projects described include:

The labour-based contracting programme, which is targeted at manual routine maintenance activities

The fixed unit rate mechanised contracting programme, which is targeted at providing affirmative support to emerging contractors to develop their capacity to undertake routine mechanised maintenance

The Uganda Transport Rehabilitation Project, aimed at the rehabilitation and maintenance of feeder roads in the four districts of Mbale, Pallisa, Tororo and Kapchorwa in Eastern Uganda

The African Development Bank (ADB) rural feeder roads rehabilitation and maintenance project, involved in routine maintenance of rehabilitated roads

Reintegration of demobilised soldiers programme, aimed at providing demobilised soldiers with skills and employment in rehabilitating feeder roads in ten districts

Projects under the Ministry of Planning and Economic Development labour-intensive project, which include the multi-sectoral project in Karamoja; the rehabilitation project in Luwero district; promoting local building materials project; South-West feeder roads project; and Masulita development project.

For each project described, a brief summary of the objectives, funding, project activities and details pertaining to equipping of the contractors is provided. The paper concludes that the experience from the various projects indicates that the prospects for labour-based technology are good, and the high level of government funding enhances the sustainability of small-scale contractor development. However, the following issues are noted as requiring attention:

Co-ordination between different implementing agencies, particularly in the areas of policy and training





Equipping of contractors: the leasing of equipment and plant hire pools requires further assessment

Correct tool usage

Standard guidelines for management of labour-based works

Follow-up of projects on completion.

These issues, it is hoped, will be addressed by the new project 'support to labour-based policy promotion initiative', which aims at the integration of labour-based approaches in national planning and policy, development of the capacity to implement labour-based works, and research and development.

#### 4.1.1 Discussion highlights

**Use of fixed unit rate contracts** There is need, in the short term, to maintain the use of fixed unit rate (FUR) contracts in order to develop small scale contractors. However, this should give way to competitive bidding once small contractor capacity has developed.

**Co-ordination of labour-based initiatives** The need for harmonisation of the activities of various implementing agencies and donors involved in labour-based activities. For example, in Kenya a donor secretariat was established where the ILO played a co-ordinating role. A co-ordination unit co-funded by the ODA (now DFID) has been set up in Uganda to help resolve this issue. Provisions have also been made in the ten year road sector plan (1997-2007) for a co-ordination unit to be financed by DANIDA. A national road authority is now also being considered and should be in place in two years.

**Lengthman contract systems** It was observed that the use of lengthmen contracts in many countries was fraught with problems of supervision, delayed wages and lack of handtools. To overcome this problem Uganda is planning to increase the length of road being maintained by each lengthmen contract from 2km to 50km. In addition, the problem of supervision could also be addressed through the transfer of part of the supervisory role to the contractors themselves. Term contracts of six months to a year are also being floated.

**Equipment leasing** The idea of setting up an equipment leasing pool has been considered in various fora and is still under debate. It was noted that leasing of equipment to contractors should be considered as it would guard against misuse and poor maintenance of government equipment.

**Training** The need for training, which is crucial and indispensable to successful implementation of labour-based roadworks.



## 4.2 MART QUESTIONNAIRE ON TOOLS AND EQUIPMENT

Paul Larcher, MART, Institute of Development Engineering,  
Loughborough University, Loughborough, UK

The paper defines the objective of the ILO/MART hand tool and intermediate equipment questionnaire, which seeks to obtain data on handtools use and performance, commonly used items of equipment and their availability, the manufacturing capacity in different countries, available standard equipment designs and specifications, and the problems associated with use and procurement.

The main observations from the returned questionnaires are presented. It is observed that good quality tools are important in achieving good productivity. Respondents expressed satisfaction with the productivity of the handtools used. It is noted that when tools are new, there appears to be little difference in the productivity of different quality tools. However, as tools wear out and distort, the productivity of lower quality tools will drop off more rapidly. Further investigations into this are currently being carried out.

The main criterion for selecting and procuring handtools is reported to be their ready availability 'off-the-shelf'. Where a number of brands are available, if technical staff handle procurement, brands which best meet specifications tend to be chosen, whereas if a tender board is responsible there is more emphasis on lower cost. If use of better quality tools is to be encouraged, they would need to be readily available 'off-the-shelf'. From the responses to the questionnaire, acceptability is usually limited to visual inspection. None of the respondents reported the use of strength or hardness tests as recommended in the ILO guidelines. The overall impression gained from the questionnaire is that projects 'make do' with the handtools that are readily available and that these are adequate for the task rates being set.

In the case of intermediate equipment, responses show a serious underdevelopment of the intermediate equipment sub-sector. Many decision-makers do not have the knowledge or the supporting environment to make rational decisions and cost-effective decisions regarding whether to use labour, intermediate equipment, or heavy civil engineering plant. Manufacturers and suppliers are also not aware of the exact needs and potential for intermediate equipment. As such, they are not able to provide optimal solutions for their clientele. The paper concludes that the most serious problem is the lack of cost-awareness regarding the real owning and operating costs of all equipment. This is compounded by the lack of genuine management pressure on road authority personnel to seek cost-effective solutions and performance, thus reducing inclination to change to a more rational approach regarding equipment selection and use. The following are the principal issues identified for further research and development:

Lack of awareness regarding intermediate equipment



Poor cost awareness regarding all equipment (particularly intermediate equipment)

Non-availability of designs and specifications for procurement of intermediate equipment

Weak procurement arrangements for intermediate equipment

Inadequate training in the use of intermediate equipment

Poor availability of finance for intermediate equipment

Poor availability of intermediate equipment for hire

Poor dissemination of information about intermediate equipment.

The paper suggests initiatives towards solving these problems and outlines the MART programme initiatives in addressing the problems.

#### 4.2.1 Discussion highlights

**Procurement** There is a need for a centralised procurement system to guarantee manufacturers a market for improved quality implements and equipment. Some participants felt centralisation stifles the growth of small enterprises.

**Local manufacturers** Most tools used on labour-based projects are designed for agricultural use or adapted from agricultural implements. The market for tools that are specific for roadworks is limited. In order to encourage manufacturers to produce tools suitable for roadworks, it was suggested that the tools should be manufactured to be suitable for agricultural work as well.

**Handtools and productivity** It was noted that the effect of hand tool quality on productivity in labour-based work where task rates are used may not be significant. However, it was pointed out that a good tool improves the morale of the worker and the speed at which a task can be completed. This would enable the setting of higher task rates which would consequently lead to higher output.

**Use of the agricultural tractor** A debate ensued on the applicability of the agricultural tractor. Two schools of thought emerged. One in support of the use of the tractors, as they are multipurpose and are readily available in the market throughout Africa. The other argued that the agricultural tractor is a ploughing device and not a pulling device suitable for roadworks.

**Information dissemination** It was suggested that the advantages and disadvantages of various pieces of tools and intermediate equipment need to be published and disseminated.



### **4.3 FEEDER ROADS PROJECT IN EASTERN ZAMBIA EXPERIENCES WITH PROCUREMENT OF EQUIPMENT AND HANDTOOLS FOR LABOUR-BASED ROAD MAINTENANCE AND REHABILITATION WORKS**

Alfred Sakwiya, Ministry of Local Government and Housing, Zambia

The paper describes the procurement experiences of a rural feeder roads project in Eastern Province, Zambia. The project was co-funded by the Government of the Republic of Zambia (GRZ), the United Nations Development Programme (UNDP) and the United Nations Capital Development Fund (UNCDF) at a cost of US\$ 6.9 million, of which US\$ 0.8 million was for procurement of handtools and equipment for labour-based road maintenance and rehabilitation works.

The main objectives of this project were to develop capacity at district level to plan, design and manage road rehabilitation and maintenance works using small scale labour-based contractors; to develop the private construction industry to undertake roadworks using labour-based methods; and to improve rural access and create employment. The expected outputs of the project included: district and national staff trained in design, planning, management, supervision, and inspection of rehabilitation and maintenance contracts; an efficient system for contract management, monitoring and evaluation; the development of small-scale road maintenance and rehabilitation contractors; the rehabilitation of 500km of road and the maintenance of 700 km of roads; and the creation of 900,000 worker days of employment.

The project has registered considerable progress. Fifteen maintenance contractors and ten rehabilitation contractors have been trained and are performing satisfactorily. Fourteen council supervisors in seven districts are under training. In terms of actual roadworks, 21km have been rehabilitated and 60km of roads maintained. About 70km of rehabilitation contracts and 190km of maintenance contracts have been prepared. A total of 15,000 worker days have been generated on maintenance works and 30,000 on rehabilitation works.

Procurement was successfully undertaken and completed within a record time of only six months. The procurement was done for three main purposes: to equip district staff involved in design, preparation and management of labour based contracts; to equip the contractors with handtools for maintenance and rehabilitation; and to procure equipment required for the project office. Four procurement options were available to the project:

Through the executing agency (MoLGH)

Through the funding agency (UNDP and ILO)

Through IAPSO (UN procurement agency)

Through direct purchase in the project area.



The procurement process for each of the different purposes is described in detail. Based on the experience of this project, the following recommendations are made:

The ILO guide to tools and equipment needs to be revised to include engineering survey and soil testing equipment; to list manufacturers of good quality handtools in different project areas and to provide contact details

A checklist should be prepared to ensure that clients are equipped with correct tools and equipment

Current information on manufacturers and suppliers of survey and soil testing equipment in different project areas should be readily available

Detailed construction drawings and specifications for water bowsers, steel compaction rollers and culvert moulds, with practical tips for the manufacturing process should be made available

Procurement regulations should be simplified to facilitate planning.

Overall, the project did not encounter severe problems with procurement. Handtools were procured within three months and equipment within six months after initiating the process.

#### **4.3.1 Discussion highlights**

From the discussions, it was generally evident that successful procurement is a function of consultation with, and involvement of, all stakeholders. The main stakeholders are: the government, local councils, manufacturers, contractors and the project itself.

During equipping of labour-based contractors in Zambia the project itself was allowed to procure equipment, thus bypassing the usual bureaucratic bottlenecks. The procurement period was about six months. Usual procedures could have taken up to two years. The procurement process was successful because of the absence of procurement blueprints. Most projects start late, hence a blueprint for procurement may not be applicable two or three years later after the project is actually implemented. Others felt bypassing set regulations may promote corruption.

Developing equipment needs prototypes and entails a long time frame. Due to limited funds and time available the Zambian project bought equipment available off-the-shelf. This led to the question, when will the time be right to start developing appropriate equipment, especially if we want to promote the local industry?

It was also evident from the discussions that while the ILO's Guide to Tools and Equipment has been useful in facilitating the procurement process, there is a need to review and update it. This would go a long way in facilitating the procurement process.



#### **4.4 EQUIPMENT PROCUREMENT FOR THE DNEP/DFID FEEDER ROADS PROJECT, MOZAMBIQUE**

Rob Geddes, Scott Wilson Kirkpatrick, Zimbabwe

##### **4.4.1 Background**

The paper provides a general account of the procurement process for equipment ordered by the Mozambique National Directorate of Roads and Bridges (DNEP) for a feeder roads project in Zambezia Province, Mozambique. The project is jointly financed by DNEP and the Department for International Development (DFID) of the United Kingdom. The project's main objectives are the rehabilitation of tertiary roads and the development of capacity in the local construction industry. Works are to be implemented by emerging small-scale contractors, being trained by the project. The project is relatively equipment-intensive, with the cost of equipment estimated at 25 per cent of total project costs. The project provides an opportunity for contractors to eventually purchase the equipment. It is nationally implemented, with support from DFID-funded consultants. The project duration is five years, ending in September 2000.

Selection of contractors was undertaken by DNEP, on the basis of their experience, calibre of staff, equipment already owned, financial status and perceived entrepreneurial ability.

As of July 1997, 60km of roads had been rehabilitated to all-weather standards and 40km were under routine maintenance. Six contractors are currently working at different sites.

The list of equipment for the project was based on the standard list for Feeder Roads Programme brigades. The quantity was calculated to allow for some contractors purchasing more equipment when their operations expanded. The full purchase price, including taxes, was used in deriving rental and hire-purchase rates. Items of equipment not bought by the contractors are to be held centrally and will be available for hire. At the end of the project, this equipment will either be disposed of or retained for hire.

The procurement of equipment was done by the consultants through an associated company. The equipment was ordered in two consignments to reduce the risk of over-supply. All items of the first consignment have been received. However, the preparation of documentation for some items was delayed in Mozambique due to the large numbers imported and the need for translation of documents into Portuguese. The ordering and delivery of the second consignment has commenced, with some items already being received. The key to success was the decision to manage the process at a local level. A Mozambican administrator was recruited who had a thorough knowledge of Quelimane (a port some 1600km north-north-east of Maputo) and some experience in dealing with the various agencies involved in the process of importation. Through DNEP, the project



undertook to pay some customs obligation in Quelimane, thus reducing delays in deployment of equipment to the sites.

The cost of procurement is estimated at US\$3.0 million, of which 74 per cent has so far been spent, while a further US\$300 000 has been committed in orders for the second consignment.

The equipment is owned by DNEP, which hires it to contractors. The hire rate has been calculated to reflect the true cost of owning and operating the equipment and includes 12 per cent interest per annum. Payments are made by the contractors through deductions from their monthly certificates. The contractors are free to buy equipment according to their requirements. The plant is managed by the Provincial Department of Road's (DEP) Plant Manager, who is also the counterpart to the consultant. The Plant Manager supports the mechanical technicians, employed by the contractors, in plant maintenance and repairs.

Most of the tractors ordered for the project are Massey Ferguson 240s (50hp), which have sufficient power for most site activities. However, severe problems have been experienced on site with the tow hitches. The design of the 3m<sup>3</sup> Herculano trailer, with 20-inch wheels located towards the rear of the trailer, results in the transfer of excessive weight to the tractor. This leads to shearing of bolts on the tow-hitch and even breaking of the tow hitch. Modifications are being considered to rectify these problems.

From experience, pedestrian rollers have proved unreliable in the long term in remote places where service back-up facilities are not available. To counter this tendency, a decision was taken to provide towed rollers as well. Because of the low level of traffic on the roads, the alternative approach of simply allowing traffic to facilitate compaction is not appropriate in Zambezia.

#### **4.4.2 Discussion highlights**

The discussion was mainly centred on local procurement and its associated problems. It was generally observed that while local procurement may seem an attractive proposition, it has serious limitations. The main bottlenecks to local procurement identified include:

lack of know-how and capacity on the part of local officials

bureaucratic tendencies

absence of some goods or services from the local market. Where goods or services are locally available, they tend to be overpriced.



#### **4.5 MOBILISING THE PRIVATE SECTOR TO ENGAGE IN LABOUR-BASED INFRASTRUCTURE — A SOUTH AFRICAN PERSPECTIVE**

Ron Watermeyer, Soderlund and Schutte Inc., Consulting Engineers, Johannesburg, South Africa

South Africa has undertaken reforms aimed at facilitating job creation through private sector involvement. A Green Paper on public sector procurement reform has been formulated. It focuses on ensuring that the foreign content in contracts involving goods and services is minimised. The other aspect of the Green Paper focuses on employment of small-scale entrepreneurs, and on encouraging technologies that substitute labour for capital. These initiatives are in line with constitutional provisions. The new South African constitution requires that all organs of state employ contracting systems that ensure fairness, equity, transparency, competitiveness and cost-effectiveness.

Presently, employment-intensive practices involving mainly small scale private contractors are in use in a wide range of infrastructure works. These range from rural gravel roads, bridges, dams, townships, low voltage electricity reticulation and storm drainage to construction and building works.

##### **4.5.1 Implementing employment intensive technologies**

Currently in South Africa it is evident that, while small-scale enterprises readily implement labour-intensive policies, established companies need to change their work methods so as to reduce reliance on capital-intensive technologies.

The number and location of employment opportunities generated are dependent on the choice of technology and the construction and manufacturing methods adopted. Implementing employment-intensive technologies in construction may be indirectly achieved using one of two methods:

Specifying the technology and method of construction or manufacture. This method usually achieves stated objectives, but is subject to the designer's ability to forecast costs, if economic viability is to be retained

Allowing tenderers to choose their own technology and methods. This method calls for creativity on the part of the tenderers to arrive at the optimum mix.

One of the main aspects that comes into play in implementing employment-intensive technologies is the tendering process. Experience so far has shown that, in force account works, there is a danger of ignoring the true construction costs, as records are often limited to outsourced items, *e.g.* materials and labour. The costs of supervision, plant, establishment, *etc.* are invariably absorbed in the overall running cost of the organ of state, and are seldom separated.





The tendering and contracting system, on the other hand, allows for cost comparisons of labour- and plant-based works.

Successful involvement of the private sector in labour-based infrastructure works requires, on the one hand, appropriate specifications and contract strategies involving tools and earthworks, as well as construction materials. On the other, it involves some form of affirmative action that focuses on small enterprises owned by disadvantaged groups. This should be aimed at increasing the volume of work available and increasing income generation. In pursuing affirmative action, it is recognised that procurement is a policy issue and that "value for money is not necessarily the lowest price". Issues of human resources and technical specifications come into play in the procurement process. Human resource specifications set goals for the engagement of targeted labour and local resources. The performance of contractors in achieving these goals should be definable, measurable, quantifiable, verifiable and auditable. In turn, it is necessary to classify contracts depending on the human resource and technical elements involved. This should help in allocation and targeting of contracts to achieve desired development objectives, as well as setting levels of performance bonds.

A mix of development objectives and price mechanisms are employed. The terms of these mechanisms mean that tenderers are awarded points for, in the first instance, their financial offers and, in the second instance, the extent to which their offers achieve socio-economic objectives. This enables tenderers to use their skill, knowledge and creativity in arriving at a favourable mix between economic and development objectives. This system also penalises those persons who fall outside the targeted groups, or who offer to meet certain socio-economic objectives to only a limited degree. However, the system does not preclude them from tendering in a meaningful manner. Those who fall within a targeted group are prevented from presenting grossly non-competitive tender prices. This is because the reward for compliance with socio-economic objectives will be outweighed by the loss of points incurred through non-competitive tender prices.

Appropriate standards and innovative contracting systems are the key parameters for successful private sector involvement in labour-based works.

#### **4.5.2 Discussion highlights**

The discussion centred mainly on the need for a conducive policy environment that would successfully involve the private sector in labour-based works. At the centre of this policy environment there should be a contracting system that ensures that the often disadvantaged small-scale contractors are not excluded. The issue of specifications and standards featured prominently in the discussions. Some participants thought specifications and standards ought to be emphasised, while others felt that the issue should be left to the competitive market.



A proposal was made for the classification of contractors to match equipment they possess, and work they can undertake, to ensure that small-scale enterprises are not excluded from labour-based works contracts. Others observed that classification of contractors and the application of fixed rates could be counterproductive to their growth and development. Instead they should be subject to competitive bidding right from the start.

Concern was raised about the possibility of performance bonds leading to the exclusion of micro-enterprises when awarding contracts. It was clarified that in South Africa a system of variation in percentage of performance bonds is applied, depending on the classification of enterprises and contracts. The micro-enterprises are usually not required to provide performance bonds.

On procurement it was noted that the contractors are allowed to choose their own tools. Nationally applied standards and specifications tend to stifle innovation. Setting out deliverables and measurable outputs rather than standard specifications on tools used would be preferred. It was further noted that the contractors in South Africa are perhaps innovative enough to determine their own needs, hence standards may not be an issue.

South African is atypical of other African countries. It is a relatively high-wage economy and has the advantage of being able to finance most of its projects. As such, it can specify whatever procurement systems it deems fit. Other African countries, because of dependence on foreign funding, do not have the leverage to specify which system of procurement is used. The World Bank, for example, tends to set standards that do not favour local companies, contractors and goods.

It was noted that small-scale contractors can benefit from partnerships and joint ventures with established contractors. In South Africa it was noted that as much as 60 per cent of capital is often locked up in joint ventures.

#### **4.6 EQUIPPING TRAINED LABOUR-BASED CONTRACTORS — THE GHANAIA EXPERIENCE**

E. N. K. Ashong, Department of Feeder Roads (DFR), Ghana

Ghana has had considerable experience with equipping trained contractors, dating back to 1986. Starting with seven contractors, the number has steadily risen to 96 to date. However, 36 of them are yet to be equipped. The paper describes the Ghanaian experience with training and equipping contractors for labour-based roadworks.

To begin with, an argument as to whether or not to equip trained contractors is presented. The two schools of thought on the issue are:

"Trained labour-based contractors should be 'thrown' straight into the competitive environment. Success here will be a real measure of ability".



"In order to develop a successful and sustainable labour-based programme, there is a need to initially guide and guard the contractors, while their capacity is allowed to grow".

Ghana subscribes to the second school of thought, upon which this presentation is based.

#### **4.6.1 Status of the Ghanaian Programme**

With technical support from the ILO at the onset, seven contractors were supplied with equipment worth a total of US\$ 150 000, recoverable in four years with interest. Each contractor was equipped with three tractors, six trailers, one tipper truck, one towed water bowser, one pedestrian roller, one chain saw and a set of handtools.

Later packages however, were expanded to include a pick-up and another tipper truck. Typically, less than 10 per cent of the equipment supply is funded by government. This represents a high level of donor dependence.

#### **4.6.2 Factors affecting equipment loan recovery**

While it is often assumed that contractors will be guaranteed continuous work, experience in Ghana and elsewhere has shown that budgetary constraints render this assumption unrealistic. On the part of the contractor, experience has shown that his ability to repay the loan is influenced by his own actions, the client's actions as well as the loan management bank.

Ghana's experience with competitive tendering (which also has a bearing on loan recovery) has shown that this system leads to procurement of equipment that has not stood the test of time or equipment that is inappropriate for the intended use. This has often led to the realisation of low outputs. For example, a tipper truck costs about 32 per cent of the equipment loan, but does not contribute significantly towards the physical output. This is because it is basically used for long distance haulage of inputs like cement and fuel. A cheaper low-bed truck would be preferable.

It has also been observed that the actions of the contractor have a direct bearing on his ability to repay the loan. The use of worn-out tools, delays in servicing equipment, and diversion of funds are some of the factors that tend to lower contractor productivity.

From experience so far it is recommended that, in order to improve loan recovery, selective bidding methods be employed. In so doing, it is possible to ensure procurement of equipment that has stood the test of time. Also, it is recommended that loan repayments be in local currency, and the interest payments be on a quarterly rather than on a monthly basis.

In spite of the problems encountered, loan recovery was generally good in the case of Ghana. So far, over 70 per cent of the contractors



have completed payments on their loans for equipment. The outstanding 30 per cent have only small balances to clear.

The Department of Feeder Roads (DFR) is still faced with the challenge of 36 trained contractors yet to be equipped. On top of this, 17 new districts have recently been created. Consequently, 17 more contractors will need to be trained and equipped.

The main thrust for the future for DFR will be towards maintenance activities. Contractors will be classified into three groups based on equipment holding and type of work to be executed, as follows:

Category I: Equipment holding of US\$150 000

Category II: Equipment holding of US\$70 000

Category III: Equipment holding of US\$30 000

This will be done with the objective of encouraging healthy competition, early loan repayment, maximisation of the use of limited funds and larger coverage for contractors. At the same time, the DFR intends to cautiously create protected plant pools to specifically support non-equipped contractors.

In conclusion, it is observed that trained labour-based contractors definitely need equipment. However, correct packaging of equipment and assured work availability are necessary to avoid waste and an excessive burden of loan repayment.

**Note** *There was no discussion on this presentation because of time constraints.*

#### **4.7 CHOICE OF HAULAGE EQUIPMENT FOR LABOUR-BASED WORKS**

Walter Illi and Bruno Illi, Norconsult, Kenya

This paper attempts to introduce the factors to be considered in selecting haulage equipment based on sound economic reasoning. The choice of haulage equipment is important because it represents a significant component of total construction costs. In some projects, it has been calculated to be as high as 35 per cent.

Looking back at the history of equipment choice for labour-based rural roadworks, it appears that the use of the tractor-trailer combination to haul material has always been considered to be the cheapest and most appropriate technology. This approach was very much in line with common donor policies. It was also supported by a number of publications and studies that were conducted in the mid-1970s and early 1980s, such as the World Bank, *Labor-based construction programs. A practical guide for planning and management*, published in 1983.

However, as detailed in the paper, with the passage of time together with changes in technology, prices, the economic environment, *etc.*, this assertion may no longer hold true. Besides, the assumptions employed then are no longer relevant to the present situation. This warrants a critical look at the various aspects of haulage if solutions



suited to the present circumstances are to be derived. For example, today's tractors have higher-powered engines, while their trailers are more sophisticated and are smaller. Again, recent evidence from some field studies has shown that tipping trailers are a non-viable option. It has also been established that the lifetime for some trailer models has proved shorter than was anticipated. Evidence so far points to the need for purpose built trailer designs and hitching methods.

In terms of changes in the market environment, it is observed that, in the past, the supply of trucks was limited to a few manufacturers. Today, in the increasingly liberalised economy, monopoly is giving way to competition. Indicative figures from Kenya, Zambia and the World Bank Guide reveal that costs for tractor/trailers have risen by 350 per cent, while the price increase for trucks has only been about 260 per cent. Pricing policies, taxation, *etc.* in the most countries have changed significantly over the years. All this necessitates a review of the various aspects of haulage.

#### 4.7.1 Conclusions and recommendations

Significant changes have taken place over the past 20 years. The choice of haulage equipment should be assessed in light of current trends, relevant to the actual situation on the ground.

The use of computer spreadsheet programmes is recommended for calculation of haulage rates, which should be separated into fixed costs, operating costs, overheads and profits. Calculations should be based on actual equipment running times rather than estimated annual average utilisation.

In terms of haulage equipment, it has been established that a tractor-tipping trailer combination for haulage between 5-6 km appears to be viable. Haulage costs using trucks and tractor-non-tipping trailer combinations over distances less than 2.5 km are apparently equal. Trucks are 50 per cent more economical over distances greater than 12 km. The highest possible output is achieved by 7-8 tonne tipper trucks. The flat bed or tractor/tipping trailer combinations can achieve 40-80 per cent of the tipper trucks' capacity. Finally, it is now apparent that there is little evidence of successful use of tipping trailers. These are considered as not viable.

#### 4.7.2 Discussion highlights

The discussions emphasised the need for researched and documented conclusions on the choice of haulage equipment. Comparative cost analyses of various equipment types and trials of new methods of haulage were called for. In doing this, emphasis was laid on realistic assumptions, based on the situation presently found in different countries.

**Tractor-trailer combination versus truck** There is still a need to carry out practical cost comparisons between tractor-trailers and trucks considering such aspects as utilisation rate and availability.



At the current price levels, trucks are relatively cheaper than the tractor-trailer combination. Further research is necessary.

It was generally observed that trucks are hostile to hand-loading, but if equipped with a tipping mechanism this facilitates off-loading. Tractor-trailer combinations, on the other hand, are more easily loaded by hand and have the advantage of being able to leave the trailer being loaded/unloaded, while the tractor is deployed elsewhere.

**Tipping trailers** It was generally agreed that traditional hydraulic tipping trailers were not durable and that the tipping mechanism has tended to pose problems during operations.

In Kenya, manual tipping trailers have been used with reasonable success, although some problems were experienced when dealing with cohesive material. The tipping angle was not adequate and restricted off-loading.

**Other haulage options** Suggestions for investigations into other haulage options were given, such as tractor-drawn scoops (used for dam construction in Zimbabwe) and dumping ox-drawn carts (used in Swaziland).

## 4.8 AGRICULTURAL TRACTORS IN ROADWORKS — SLIDE SHOW PRESENTATION

*Rob Petts, MART, UK*

The slide show illustrated tractor applications in paved and unpaved roadworks. Slides shown included:

- Tractor technology used in the UK for rehabilitating bitumen roads: heated bitumen distributor; towed bitumen mix spreader
- Heavy and light towed graders: Arthur Garden towed grader manufactured in Zimbabwe; Turbograder manufactured in Kenya
- Trailers: trailer with side doors used for gravel haulage suitable for labour loading and unloading used in Zimbabwe (manufactured by Tinto); tipping trailers
- Towed drags; water bowzers; and dead weight compaction equipment were also shown
- Reconditioning of old trucks at a cost of approximately US\$7000 each has been successfully carried out in Cambodia.

### 4.8.1 Discussion highlights

It was stressed that agricultural tractor technology, particularly as regards maintenance, offers a cheaper and more flexible investment which is better suited to the situation in developing countries. The costs of owning and operating tractor equipment can be considerably lower than for heavy plant to achieve the same work output.

Experience from the Roads 2000 Project in Kenya indicates that both the 100hp 4 WD tractor with a towed grader and an 120hp motor



grader are capable of similar physical performance. However, a cost comparison in terms of utilisation has shown that the motor grader is more expensive in US\$/day terms, other things remaining constant. For contractors, this finding is of significance as it means that it will be cheaper to repay a loan for a tractor/towed grader than for an 120hp grader.

#### **4.8.2 Advantage of agricultural tractors over specialised equipment**

Sophisticated imported heavy machinery is often characterised as being dedicated in function (can only be used for one operation); interdependent (operating as a fleet); consuming foreign exchange for purchase, spares, *etc.*

Imported heavy machinery is often associated with a limited local market and consequently few dealers able to provide back-up service. Besides, frequent model improvements create problems in stocking spare parts and bring about procurement problems which result in high overall costs.

Tractors, on the other hand, provide options for both paved and unpaved roadworks. They represent a natural progression from labour to machines. They are versatile and have low capital requirements as well as low operating and maintenance costs. In spite of these advantages, there is still a need for further investigation into the appropriateness of tractors for labour-based works.

### **4.9 REHABILITATING AND MAINTAINING SURFACED ROADS**

A O Bergh, P J Hendricks and I Cassiem, Division of Roads and Transport Technology, CSIR, South Africa

This paper describes the labour-based upgrading methodologies used in a pilot project in Phuthadithaba, North East Free State, South Africa, for upgrading gravel streets using the existing structure as a sub-base. Traffic volume on these streets is generally less than 500 vehicles per day, of which heavy trucks account for less than 10 per cent. The detailed techniques are serialised in teaching manuals published by the Division of Roads and Transport Technology of the CSIR.

To begin with, a centre line for an existing street is established using the best applicable features. These could be boundary beacons, fence-lines, electricity poles or fronts of houses. Once the centre line has been established, a smooth rolling grade is then determined, using pegs and a sisal string. Adjustments are made to reduce the amount of earthworks at later stages. Prior to surfacing, the main storm water spinal drain is put in place. Where relatively flat slopes obtain, they are checked with a dumpy level to ensure that sufficient fall has been obtained. The appropriate cross fall, usually varying between 2 per cent and 2.8 per cent, is selected. This determines the amount of earthworks to be done by hand labour. The final concrete level of the drain is used as reference points along the length of the road for



determining the levels of the opposite edge. Levelling of the sub-base, filling, watering and compaction (by existing traffic), are then undertaken. Compaction is further reinforced using a BOMAG 65 pedestrian roller. Care is taken to ensure that the levels of the sub-base are accurately constructed, to assist in the laying of steel shutters when the emulsion treated base is placed.

In-situ material thickness (10mm desirable) is checked by carrying out a survey using a Dynamic Cone Penetrometer (DCP). From an economic point of view, use of locally available materials (decomposed dolerite in this case) is recommended. Tests are carried out on gravel from site and elsewhere to determine plasticity and to arrive at the appropriate treatment for the materials (2 per cent emulsion, 1 per cent cement and 1 per cent lime selected for this project).

When it comes to construction, each street is split into half widths, to facilitate hand screeding of materials. The concrete side drain forms a continuous level to which the emulsion treated base (ETB) is placed. To overcome the problem of coarseness, grading of the material is done using coal forks from which alternate tines have been removed. By using various measuring containers, appropriate measurements and mixtures of materials are achieved. The amount of water in the gravel is also taken into account in determining the optimum degree of dilution and moisture content.

Once the road is ready for placing the ETB, the correct level of compaction should have been undertaken. The ETB is applied in two layers. The first layer is placed level with the shuttering and the second layer of ETB is placed level with the top gauges, to ensure uniformity of the constructed level of the final base. Use of ETB is advantageous in that, because of the time lag in labour-based methods, the ETB is capable of carrying traffic without surfacing for extended periods.

The last stage in the process of upgrading the road is surfacing. One of four types of surfacing will be applied on the road, depending on anticipated traffic volumes, economic considerations, *etc.* The following observations have been recorded for each type of seal:

- Single seal: suited to labour-based application if well controlled
- Double seal: probably the most difficult seal to apply efficiently with hand labour. Its success is highly dependent on experience with the efficient use of rollers
- Cape seal: strong, tough and suited for bus and more heavily trafficked roads
- Slurry seal: sound and uniform; user-friendly for labour-intensive works.

#### **4.9.1 Discussion highlights**

Labour-based techniques of road construction are particularly useful in the built-up township environment. Labour-based methods were





preferred for rehabilitation of township streets where access is limited. Use of labour-based techniques should be encouraged for major road construction as well.

The importance of careful selection and positioning of materials for successful labour-based roadworks was highlighted. The rest of the discussion centred on clarification of the various techniques employed by the project.

#### **4.10 LABOUR-BASED SURFACED ROAD AND CANAL CONSTRUCTION WITH GEO-CELLS**

Paul Malopa, Hyson-Cells, Muldersdrif, South Africa

The paper describes what Hyson-Cells are, and lists the various applications in which they can be used as well as their advantages. Hyson-Cells are a 3-D honeycomb geo-cell mat made from plastic sheeting. Hyson-Cells vary in size from 25mm to 4 metres deep and measure about 7 x 30 meters in width and length. This technology (from South Africa) has been around for over 10 years now. Hyson-Cells offer unique solutions for civil construction.

During application, they spread to a unique three-dimensional interlock, offering cell slab stability. They are watertight, but allow venting of hydrostatic pressures. Hyson-Cells are easy to use, are cost-effective and applicable even where clay or sand soils are a problem for normal construction. Where applied, traffic flows can resume in a matter of hours, thus causing less disruption to community life during construction. Hyson-Cells allow for use of local materials, and are ideal for varying water tables and unstable soils. Above all, they offer opportunities for community involvement in construction, promote small-scale business and are suited to labour-based technologies.

In terms of application, Hyson-Cells have proved useful in various construction fields such as labour-based roads, storm-water drains and canal linings, embankment protection, erosion control, dam, weirs, spillways and maturation ponds. They easily overcome problems associated with terrain and soil conditions. To date, over 1 000 000m<sup>2</sup> of Hyson-Cells have been installed throughout Africa, and demand is growing.

##### **4.10.1 Discussion highlights**

During discussions, it was emphasised that engineering considerations at the preparation stage are very important, if successful laying of the Hyson-Cells is to be achieved. For example, for roadworks an in-situ compaction of a 150mm layer is required before cells are laid.

The rest of the discussion was mainly concerned with some of the technical aspects of Hyson-Cells and their applications.



#### **4.11 APPROPRIATE HANDTOOLS FOR LABOUR-BASED ROADWORKS**

Gary Taylor, IT Transport Ltd., UK

The paper discusses factors affecting handtool quality and the influence of tool quality on the productivity of the labour force. A review of the results from recent tests in Ghana and Kenya on the effect of tool wear on productivity is also presented.

The paper reaffirms that productivity is a function of effective organisation, supervision, motivation and quality of tools and equipment used. However, although it is generally agreed that handtool quality is very important to the cost-effectiveness of labour works, there appears to be virtually no documented experience to support this view. (The presenter expressed the hope that the seminar would be able to provide some evidence from the wealth of experience of its participants.) The presentation goes on to define the factors that determine quality of handtools. These are: ergonomic efficiency (angle); strength of the tool; and wear and durability.

Analysis of a number of labour-based projects in Ghana, Lesotho and the Philippines has shown that labour costs are typically 40 per cent of total construction costs in labour-based roadworks. At least half of this cost is from earthworks. With earthworks and gravelling activities making up over 80 per cent of labour costs, the impact of productivity on the cost-effectiveness of labour-based works becomes quite obvious. The relationship between quality and productivity of the main tools used — hoes, shovels, pickaxes/mattocks, wheelbarrows and rakes/spreaders — is therefore very important. Since the cost of handtools is typically between 2 per cent and 5 per cent of overall construction costs, increased labour productivity achieved with good quality tools will have a significantly greater impact on overall costs than the purchase cost of the tools themselves.

The paper asserts that better quality tools are likely to have a longer life span, and to cut down on replacement costs, and to impact positively on productivity. The potential improvements in productivity however will depend on labour relations, effectiveness of supervision, and the way payments are effected in the field. For example, where daily rates are used, with effective supervision, daily output should increase. For task rates, to achieve improved productivity, daily task rates should be increased. The potential for this depends on effective supervision and labour relations. In the case of piecework, improved productivity will increase volume of work per day, but direct cost savings can only be achieved if unit rates are reduced – which may be difficult to justify. Moreover, even where better handtools application on site does not necessarily produce cost savings, it motivates workers (reduced time and effort).

##### **4.11.1 Field experience**

In terms of documentation, the paper asserts that the tendency has been to emphasise specifications and procurement rather than



performance and impact on productivity. Only a few field tests have been recorded, such as tests on handtool quality in Kenya.

From ergonomic efficiency and strength tests so far undertaken to compare quality of farm and construction tools, the only significant difference found in worker productivity was for hoes. The construction hoe recorded 12 per cent higher productivity, compared to the agricultural hoe. For strength, considerable differences were recorded. The farm type experienced far more failures. Losses in productivity due to broken tools varied with working arrangements. However, generally speaking, losses are likely to be significant where tool failure is more common.

Tests on the effect of wear of handtools in Ghana compared two work forces, one with badly worn-out tools and the other with new tools. The time for completing the daily task for each worker was recorded. Workers were also asked questions on tiredness, difficulty in completing the task and performance of tools. It was established that, for ditching and sloping, the average increase in time taken to complete daily tasks using worn tools was 22 per cent and 6 per cent respectively. Ditching is more strenuous; hence the greater loss of productivity recorded.

In tests on the effect of wear on handtools in Kisii, Kenya, three groups of tools were used: new, partly worn and badly worn. The results showed that, because of competition between workers to complete the tasks, those using worn tools worked considerably harder to keep up with those using new tools. At the end, those using worn tools were found to be considerably more tired. It would appear that, if all workers were to use worn tools in this experiment, the increase in task time would have been 15 per cent to 20 per cent for worn tools, and 5 per cent to 10 per cent for part-worn tools.

The paper concludes, on the basis of these test results, that ergonomic efficiency may not be a significant factor affecting productivity. The main problem experienced with poor quality tools is probably inadequate strength — arising from inferior steel that may not have been properly hardened and tempered — as well as breakage of handles. This conclusion appears justifiable, given that all test results on wear of handtools seem to be consistent. Clearly, there is a benefit in changing tools at about 60 per cent to 70 per cent of their current life.

The presentation ends with the proposals on improving quality of handtools for labour-based works contained in the MART programme. These include: encouraging the wider use of good quality handtools through producing and disseminating an illustrated brochure on the advantages of such tools; preparing clearer and more accessible specifications; and informing hand tool suppliers about the potential and increasing demand for good quality tools.



#### 4.11.2 Discussion highlights

The discussion covered *inter alia* the issue of handtools not having received as much attention as equipment. Concern was voiced at the lack of awareness, non-availability of guidelines and procurement difficulties.

It was observed that, in many Sub-Saharan countries (and also as observed during the field visit), handtools management on site is generally poor. Incorrect tool usage is prevalent, *i.e.* the wrong tools are used to perform various tasks. Lack of maintenance and use of worn-out tools has also been observed. There is a need to emphasise proper management of handtools on site, involving all parties concerned (government, contractors and workers).

Training of contractors, workers and the client (government) is essential to improve tool quality, application, and tool management on site. Good quality tools, it was argued, may have a limited impact on force account operations, but for a contractor, good quality tools have a major impact. The need to educate contractors on the benefits of good quality handtools — such as increased productivity and increased profits (because of increased time savings and reduced overheads) — was stressed. For the worker, good handtools result in improved worker morale and reduced exhaustion and injury.

The issue of poor quality tools was partly attributed to inadequate specifications, poor procurement systems, lack of awareness as well as poor planning. Even where specifications exist, it was observed that they are often not enforced. On the other hand, it was suggested that procurement systems are a long term problem and are difficult to change in the short run.

It was argued that task rate systems do not necessarily encourage productivity. Since tasks are pre-defined, good quality handtools are not the most important consideration for the contractor. Contractors will not be motivated to increase productivity as they are in no hurry to complete their tasks ahead of schedule. The reason given for this trend is that often they are not guaranteed further works. In piecework systems on the other hand, increase in productivity from using good quality tools means that a worker can carry out further pieces of work during the same day.

It was evident from the discussion that there was scope for both task rate and piecework systems in contracting, depending on various factors. The need for further investigation to determine which is more conducive to improved productivity of the labour force was emphasised.

### 4.12 HANDTOOLS IN THE URBAN INFRASTRUCTURE PROJECT, ADDIS ABABA

Tesfaye Kunbi, CARE, Addis Ababa, Ethiopia



This brief presentation is based on experiences of implementing a community development project in the poorer parts of Addis Ababa, Ethiopia. The project is set against a background of constant influx of people into the town (because of wars and diminishing opportunities in the countryside), leading to the population of Addis Ababa growing to 3.0 million over a short period of time. This has tended to perpetuate the development of slums, with their attendant problems — lack of infrastructure, lack of employment and rising crime.

The Community Infrastructure Development/Urban-Food-for-Work Programme, funded by USAID, was developed by CARE Ethiopia in 1993 to address the needs of the urban poor in relation to the lack of basic primary infrastructure and excessive unemployment. The project targets marginalised communities, providing food rations in the ratio of 3:2:1 for skilled, semi-skilled and unskilled workers respectively. One ration is equivalent to 3.5kg of wheat and 175g of vegetable oil.

At the community level, the project is managed through task force committees. These committees consist of representatives from the community, the municipality disaster department, local NGOs and CARE. They liaise with the project and government.

Priority is given to workers from within the locality of the project. The beneficiary community's contribution is 10 per cent of construction material costs. Community contributions are meant to encourage ownership and subsequent maintenance of project activities at the close of the project.

So far, the project is reported to have realised 80km of stone paved roads, 65 communal latrines for 1560 households, and eight protected springs. At the same time, about 135 unskilled labourers have been promoted to skilled grade. On the other hand, some problems have been encountered, the main ones being difficulty in acquiring land for an on-site sanitation scheme, owing to the government's policy on land ownership; finding immediate re-employment for participants after the one-year period of the project; and lack of follow-up maintenance. Negligence on the part of some committee members has also been observed.

#### **4.12.1 Experience with labour-based works and handtools**

The paper observes that project activities are labour-intensive, employing machinery only to the extent necessary. The handtools used are mainly locally manufactured. The life span of most of the tools is between one and two years, and they are subject to constant breakage as a result of poor grade steel, improper heat treatment, as well as improper grinding and application. On site, it was observed that low productivity is a result of the use of excessively worn cutting and working surfaces of handtools. Application of poor handtools results in loss of productivity mainly through time loss, fatigue and injury to workers. Low productivity also results from poor organisation, poor supervision and lack of motivation.



Experience in the use of agricultural tools for labour-based works construction in Addis Ababa has shown that they yield low productivity, since they are not appropriate in terms of size, weight and finish.

#### **4.12.2 Recommendations**

There is a need to create awareness on the importance of good quality handtools. Specifications are needed in a more concise and readily available manner. Testing of tools is vital and co-ordination of the market within countries to ensure sufficient demand for good quality tools is required. Finally, because of difficulties associated with the testing of tools, the use of selected brand names with proven performance is encouraged. Procurement, on the other hand, should be done well before project activities start. This will ensure proper storage and good records management.

#### **4.12.3 Discussion highlights**

The discussion centred on understanding the unique problems of applying labour-based technology in urban settings. Emphasis was made on the need for further studies within the urban sector to develop appropriate solutions, including community participation.

### **4.13 DEMONSTRATION OF SOIL TESTING EQUIPMENT**

Mike Vlok, CSIR, South Africa

The demonstration involved a piece by piece presentation of the Gravel Road Test Kit, assisted by overhead slides. The presentation reiterated that the implementation of labour-based construction techniques is beneficial in that it creates employment opportunities and assists with socio-economic development. Secondly, the performance of a gravel road is primarily a function of the material selected, as well as the testing and control of construction work.

A gravel material test kit has been developed by CSIR in collaboration with ILO/ASIST. The kit comprises simplified tools for on-site materials testing and quality control. The kit is available in three options as listed below:

- Option 1: Full kit, US\$2500
- Option 2: DCP not included, US\$2200
- Option 3: Soils test kit only, US\$2100

Depending on the type of measurement/test to be performed, the soils test kit apparatus ranges from test sieves, brushes, solar oven, balances and bottles, to clipboards. The solar oven can sustain temperatures of between 90-100°C; the sample is heated for at least three hours. Details are provided in the CSIR Field Testing Kit Manual.



Strength is measured by either a Rapid Compaction Control Device (RCCD) or DCP. The RCCD is spring loaded, and the spring is recommended to be re-calibrated after one year.

#### **4.13.1 Discussion highlights**

The main issues of discussion included: comparability of the test results with more conventional or laboratory ones; applicability of the kit to labour-based works; and the costs involved.

It was noted that the RCCD results are comparable to laboratory results. It was emphasised that the gravel road test kit is meant for quick analysis in the field. With the continual depletion of ideal gravel material the kit provides a valuable quick assessment in identifying the best gravel available.

### **4.14 COMPACTION FOR GRAVEL ROADS, TRACKS AND EMBANKMENTS**

Tony Greening, Transport Research Laboratory (TRL), Zimbabwe

Note: There was no paper circulated. This summary is based on notes taken during the actual presentation, and on the overheads.

The presentation highlighted the importance of compaction on gravel roads. Compaction reduces the rate of deterioration, *e.g.* in terms of roughness and loss of shape, and minimises gravel loss, surface erosion and dust emission. The role of compaction is to increase density and reduce permeability and thereby reduce future settlement and increase the bearing capacity and shear strength of the gravel road.

Water plays an important part in improving compaction efficiency and thereby improving the strength and density, and mobilising cohesive properties, both of which increase resistance to erosion. The moisture content is key to good compaction.

#### **4.14.1 Road performance**

Typical results indicate that where compaction is not used, extreme roughness levels may be reached at low traffic levels (<50ADT) and approximately four times faster than normal. Where water is not used in compaction, in particular circumstances, maximum roughness levels may be attained after one fifth of the normal rate.

The key performance factors are adequate water, the properties of the materials, the required standards, and appropriate equipment. Typical results indicate that dry cohesive soils and granular materials require 25 per cent to 200 per cent more effort than wet cohesive soils. Given the same soil conditions and compaction equipment, actual output in cubic metres can be two to three times lower if the compaction moisture content is below optimum.



The key factors in quality control are density and moisture. Key measurements and tools are in-situ density measurements, strength tests (using DCP, RCCD, or Clegg hammer), and moisture measurements (using balance and pans, *etc.*). For each change in soil type, these measurements are essential for quality control.

#### **4.14.2 Equipment**

The following considerations should be taken into account when selecting compaction plant: availability and maintainability; suitability in relation to dimensions and condition of the site; efficiency and cost effectiveness in meeting standards and output compatible with other operations.

On the role of compaction on labour-based roadworks, some issues for consideration are:

- Striking a balance between the use of labour and output
- Importance of local studies and field trials
- Incorporating compaction standards as a factor in decision-making
- Costs and availability of different options
- Guidelines for planners and practitioners

It is observed that there is always a danger that, in an attempt to cut costs and maximise profits, contractors will cut back on water costs. The result is low densities, thereby reducing durability and greatly increasing the road maintenance burden. There is a need for quality control of compaction.

#### **4.14.3 Discussion highlights**

In the discussions, it was generally observed that compaction plays an important role in determining the performance of the road. However, from the various experiences detailed in the discussion, it was evident that compaction is often not given due attention.

For appropriate compaction levels to be achieved, the correct moisture content is crucial. A problem is how to ensure that contractors adhere to the particular requirements, while remaining cost effective.

### **4.15 INFORMATION TECHNOLOGY DEVELOPMENTS**

David Mason, ILO/ASIST, Nairobi, Kenya

This presentation updated participants on what information resources ASIST has on offer and how these can be accessed.

ASIST provides written, researched replies to technical queries at no cost. Access to other types of information however is at cost. This includes published reports, text books, and photocopies of unpublished and out-of-print material. Also available at cost are videos on labour-based works and rural travel and transport, technical briefs, working





papers and training materials. The ASIST Source Book of key publications is available free.

In the past, requests from clients and replies from ASIST were made via the traditional means, *i.e.* post, telephone, fax, courier or telex. Currently, ASIST continues to provide information via the media mentioned above, except telex. In addition to this, information can also be received and sent via email and the Internet.

**Email** is a system for sending electronic messages via computers linked together through telephone lines. For email access you require:

	<b>Typical costs</b>
• A Personal Computer (a 486, or a Pentium)	\$2000
• A telephone line	\$3 per month
• A modem (to connect the computer to the telephone line)	\$100
• A suitable operating system (Microsoft MS-DOS 6.x, Windows 3.x, Windows 95, Windows NT)	Free with computer
• An Email Service Provider (a company to link you by telephone to the world-wide Email network)	\$10 to \$15 per month
• Email software (FrontDoor, Eudora, Microsoft Internet Explorer)	Free from your service provider
• Training in how to set up and use the software	\$50

**Internet** The Internet is a network of computers around the world, sometimes referred to as the World Wide Web. The Internet can be used to send and receive email messages and attached documents.

For Internet access you require:

	<b>Typical costs</b>
• A Personal Computer (a 486, or a Pentium)	\$2000
• A telephone line	\$3 per month
• A fast modem (to connect the computer to the telephone line)	\$200
• A suitable operating system (Microsoft Windows 3.x, Windows 95, Windows NT)	Free with computer
• An Internet Service Provider or ISP (a company to link you by telephone to the Web)	\$50 to \$100 per month
• Internet software (Netscape, Microsoft Internet Explorer)	Free from ISP
• Training in how to set up and use the software	\$50

ASIST has its own Website, and the address is:

<http://iloasist.csir.co.za>. When connected to the Website you can



browse, (*i.e.* search), view and print information while connected. Alternatively, you can download material, *i.e.* copy information to your own computer, or send an email to place an order or to send comments to the site editor.

The ASIST Website offers you general background information about the ILO and ASIST to browse or download; the ASISTDOC database to browse, select documents and send an email order or download the database; the full text of key documents to browse or download.

In the absence of an Internet connection, everything on the site will be available on CD-ROM (scheduled for late 1998). Electronic files can also be sent via email, on diskette or as hard copy.

Clients who are near UNDP offices can also receive documents from ASIST through the diplomatic pouch system.

#### **4.16 CONSIDERATIONS FOR THE DESIGN OF TOOLS FOR LABOUR-ENHANCED ROAD CONSTRUCTION AND MAINTENANCE**

Crispin Pemberton-Pigot, New-Dawn Engineering, Manzini, Swaziland

The paper highlights several basic issues ranging from the human aspects of tool use to appropriate design and use of tools in labour-based roadworks.

The paper states that ergonomics (the study of the movements, condition and efficiency of the human body) is central to the designing of tools that enhance the efficiency of the road worker. The modern truck or cart, for example, is designed contrary to this principle. It is designed for the road it travels on, rather than the people who build the road. Design of transportation taking into consideration the worker and the animals who work side by side with him is critical in labour-based road construction.

The paper then details issues connected with road construction. It observes that it is a complex process involving movement of heavy material, maintenance, upgrading, *etc.* under different climates, terrain, *etc.* For this reason, the need for contractors to be able to match the correct tool to the labour for the task at hand is very important. In the case of tool design, designers must effectively match four factors: the task at hand, the materials at hand, the tool-making skills available and the type and skill level of the labourers.

Apart from the issues already highlighted, basic design criteria are discussed. It is asserted that what a person can do with a particular tool greatly influences how much net work can be accomplished. Working against a constant resistance, gripping a handle, is hard on the human body. Using a single-wheeled wheelbarrow is also hard work, increasing the wheels to two or three improves work efficiency, as does letting the labourer expend energy on pushing only rather than pushing and lifting as well.



Animals, such as oxen, should work for only five hours a day, with a continuous pull not exceeding 50kg (equal to about 245 watts of continuous power). Yoking two oxen together only increases their available output by 50 per cent. Donkeys, on the other hand, are more robust than oxen and can work up to eight hours a day, pulling 25kg loads and turning out about 135 watts. However, to achieve their efficient use, the tools (harness, yoke, *etc.*) have to be suited to the weight, speed and temperament of the animal. Therefore, the optimal use of available labour requires deep thought about speed, load, rest, type of task at hand and motivation. This is a subject for serious research, because economic success through revitalisation of the rural economy can be enhanced by reliable labour-based civil works projects.

The paper then goes on to offer basic technical advice for Africa (which is hard pressed for equipment), arguing for tools that are durable, with parts that are easily replaceable locally. The need for simple, rugged, but largely maintenance-free machines cannot be over-emphasised.

The design of tools should ensure as much as possible that they cannot easily be broken on account of human effort. This is the case with the rock crusher from New Dawn Engineering. The use of easily replaceable substitutes such as wood and vescanite nylon for bearings, *etc.*, is recommended. Design of tools should as much as possible result in lower-cost tools that last as long as more expensive ones.

Governments are encouraged to ensure that materials for tool making are locally available, even if it means importing them. It is far cheaper to import materials for making tools than it is to import heavy equipment and feed and maintain it for years. Capital equipment is imported all the time into many countries. A lot of effort is made to see that fuel is available and staff trained. Why shouldn't this effort also be made to create mass employment? The socio-economic benefits of a high-employment rural economy will surely attract the interest of importers and economic regulators. Taxation policies in favour of imported tool-making materials rather than heavy machinery are required.

On the practical side, it is argued that all fencing made from wire can be handmade. Wire products are easy to make on a small scale. Road fences, where they are put up, should be made and erected by the people living along the particular road. Gabion structures are more common in mountainous areas where erosion is a problem. All gabion baskets, cages and Reno mattresses can be hand-made. It is possible for all the gabion-making technology to be locally produced in a welding shop. Swaziland has been implementing all its fencing and gabion works by hand and labour-based means.

Lastly, on management of construction and maintenance, it is asserted that capital-intensive projects tend to be professional-intensive, while labour-based projects are management-intensive. For each type of tool, there is a need for training workers to achieve the optimum levels of efficiency. Management of tools and workers will



make the difference between the success and failure of a project. Training of workers by other workers rather than by professionals is important in labour-based roadworks.

#### **4.16.1 Discussion highlights**

The discussion mainly emphasised the need for more local research in the area of tool design, manufacture and use. Other areas featuring in the discussion included the need for more purpose/objective oriented interaction between tool and equipment manufacturers, contractors and workers. Governments, organisations and projects with an interest in the development of labour-based works would be suited to facilitate such interactions.



## 5 Full text of discussions of the papers presented

This chapter contains the full text of the discussions prompted by the papers presented. Some 'short papers' presented during the course of discussions are also included in this chapter. They are: The FIT Programme, Mozambique's IBIS programme, and the Egyptian Social Development Programme.

### 5.1 LABOUR-BASED PROGRAMME — UGANDA COUNTRY PAPER

Eng. W E Musumba, Ministry of Works Transport and Communication, Uganda

**Remark** It was observed that the use of fixed unit rates for lengthman contracts over a ten year period, as is the case in Uganda, is necessary. This is to ensure that small scale contractors are not excluded on account of their relatively weak competitive ability and lack of experience. However, in other countries, the advantages accruing from the use of competitive bidding — such as minimising discrimination between foreign and local, small and large contractors, and promoting efficiency — could override such considerations. As such, a case by case analysis is required for arriving at the best option.

**Remark** It was noted that labour-based technology and contracting are being adopted in many countries today. The large number of actors, including various departments of government, donors and the private sector, warrant co-ordination for success to be realised. Besides, efforts by various actors are increasing, but they need to be harmonised. In Uganda currently, there is a need for coordination as well as harmonisation of the various initiatives. In Kenya, in the past, the ILO took a lead role in coordinating the various activities and initiatives. This, however, stopped some time ago. Part of the solution to this problem in the case of Uganda is the formation of a National Road Authority, expected to be in place in two years' time.

**Question** *From the presentation, it would appear that Uganda has made good progress with lengthman contracts. In other countries, problems with lack of supervision, delayed wages, poor handtools, etc. are seriously undermining the lengthman system. Do these problems also affect Uganda?*

Yes, these problems are still obtaining in Uganda. The solution lies partly in offering longer road-contracts from 2km to up to 50km. In the case of supervision, it has often proved difficult to supervise one to two kilometre lengthmen contracts. The problem of supervision could partly be addressed through transfer of more supervisory roles to contractors themselves. In Uganda, the idea of contracting supervision to one authority (the contractor), whereby a contractor undertakes to



supervise either the entire network of roads in a district or a specified length of roads, is presently being floated.

**Question** *Has the idea of setting up an equipment-leasing pool been considered in Uganda?*

In the case of Uganda, the idea has come up in various forums and is still under debate. Leasing of equipment would be a better option than allowing the equipment to lie idle, and be subject to misuse and lack of maintenance by governments.

However, from experience elsewhere, it has been observed that, while justification may appear to exist for contractors to benefit from equipment on a loan basis, repayment is likely to take a long period. This issue should be taken into account in justifying leasing arrangements.

**Question** *It would appear that there are many actors in the various aspects of labour-based roadworks. Doesn't coordination and harmonisation become an issue in Uganda?*

Coordination of the range of initiatives *is* a concern in Uganda. Attempts have been made by the MoWTC to resolve the issue of lack of coordination. A coordination unit, co-funded by ODA (now DFID), was set up to attempt to solve this problem. Also, provision has been made within the ten-year road sector plan (1997-2007), for a coordination unit to be financed by DANIDA. Likewise, the National Road Authority now being contemplated will hopefully provide a framework for tackling some of the problems of coordination.

**Question** *The reintegration of the veterans project component of the RFR project appears more like a project to remedy some social problems than a serious attempt to carry out labour-based roadworks. Are the veterans provided with tools?*

The veterans project is meant to provide skills and gainful employment to ex-combatants. The skills gained from the project are expected to enable the veterans to be more easily reintegrated into their communities. Tools are provided. However, the number of people employed through this programme are too few compared with the number of veterans. The project therefore would appear to have a limited impact and sustainability.

**Remark** Training has been observed to be essential for all labour-based projects. However, given the several initiatives and activities taking place in different countries through different programmes, there is a need for coordination and harmonisation. In Uganda, for example, an inter-ministerial committee involving the MoWTC, MoLG and MPED was established to deal with issues of training in a more coordinated manner.



## 5.2 MART QUESTIONNAIRE ON TOOLS AND EQUIPMENT

Paul Larcher, MART, Institute of Development Engineering,  
Loughborough University, Loughborough, UK

### Procurement

**Remark** There is a need for the provision or creation of credit facilities. Hire companies should be encouraged to venture into intermediate-equipment provision.

**Remark** Manufacturers should be encouraged to produce tools and equipment locally to given specifications, rather than importing them. At the same time, manufacturers should be encouraged to provide warranties. However, in order to encourage manufacturers, there is a need to coordinate the markets, so as to guarantee a viable demand for the products.

**Remark** Agricultural tools are still the cheapest and most easily available. They provide the least cost option, *i.e.* 'good price'. However, while most organisations favour the least cost option, when selecting equipment it is important to consider existing back-up service from local agents.

**Remark** Handtools are readily available in the world market and can easily be imported. Successful encouragement of manufacturers to produce tools and equipment locally to the specifications given to them can only be achieved if they are guaranteed a market for the product. The small demand for specific road handtools and equipment does not encourage manufacturers to engage in their production. There is a need for centralised procurement systems to guarantee a market for manufacturers of quality tools. Some people, however, argued that centralised procurement could stifle the growth of small enterprises.

### Specifications

**Remark** Specifications for intermediate equipment are sometimes too stringent for local manufacturers and the way they are presented is at times not appealing. There is a need to simplify and improve the language and presentation of specifications. Instead of using detailed technical language and units, simple language should be considered.

Another option could be just to publish details of poor types of tools and equipment and their manufacturers, so that their products may be avoided. Opinions differed on the legality and/or ethical acceptability of such an option. On the other hand, information on good quality handtools and equipment and their brand names should be published.

**Remark** Documentation and dissemination of information on specifications, use and operation of handtools and equipment (manuals, booklets, *etc.*), is required.



### Lack of awareness

**Remark** Lack of awareness of what tools and equipment are available in the market, their quality, and cost is still evident. Lack of awareness extends beyond cost issues to operation and maintenance (management) of tools and equipment as well as availability and the procurement process.

**Remark** There is a need for information on the performance of different types of equipment, so as to facilitate the selection and procurement process. Further, the concept of cost awareness needs to be revised in relation to prevailing conditions. In Ghana, for instance, there is a potential for a second-hand market for handtools, which should be taken into consideration. Besides, cost awareness should incorporate operating, maintenance and replacement costs.

### Guidelines

**Remark** While guidelines on the various aspects of handtools and equipment exist, there is a need to update them. Very few people seem to make any reference to guidelines, but instead opt for the least cost options. Attitudinal changes are needed among the users of handtools and equipment.

### Task rate systems

**Remark** It has been observed, in task rate systems, that site supervisors often do not take enough interest in the quality of tools and equipment. It is important that they, together with contractors, are made aware of the benefits accruing from proper use and management of handtools, and the fact that increased productivity will increase the rate at which tasks are achieved.

### Agricultural tools & equipment

**Remark** On the issue of using agricultural tools for labour-based roadworks, it was observed that most tools used in roadworks are either designed for agricultural use or adapted from agricultural implements. It was proposed to continue manufacturing tools and equipment that are applicable to both agriculture and labour-based roadworks. Manufacturing specialised equipment could shrink the market, and consequently manufacturers would not be forthcoming.

Two schools of thought emerged: one in support of the use of agricultural tools and equipment for roadworks, and the other against it. In favour of using agricultural implements, it was observed that they are still the most readily available in the market, as well as the least costly. A tractor, for example, was reasoned to have been designed for multipurpose use. Besides, it is readily available throughout Africa for agricultural purposes. Thus, it can be considered a local resource.

The argument against was simply that agricultural tools and equipment are not suitable for roadworks. A tractor, after all, is a





ploughing device and not a pulling device which would be desirable for roadworks. No conclusions were reached on this controversial subject, though it was resolved that the advantages and disadvantages of each type of equipment be studied and publicised.

### 5.3 FEEDER ROADS PROJECT EASTERN ZAMBIA — EXPERIENCES WITH PROCUREMENT OF EQUIPMENT AND HANDTOOLS FOR LABOUR-BASED ROAD MAINTENANCE AND REHABILITATION WORKS

Alfred Sakwiya, Ministry of Local Government and Housing, Zambia

**Question** *How was the project able to realise rapid success in procurement?*

Its success can be attributed to the conducive policy environment. This involves all parties concerned in the procurement process right from the start. Success is also due to the element of flexibility given to the project, enabling it to opt for the procurement system deemed most fit. Also, this project was developed without recourse to procurement blueprints, thus avoiding some of the problems inherent therein. Lastly, the highly motivated project staff had a positive bearing on the procurement process. Some members, however, voiced concern that bypassing set regulations may promote corruption.

**Question** *What were the major setbacks encountered?*

Inadequacy of some key information from ILO guidelines and non-availability of some goods locally. There is a need for updating and including 'materials testing procedures' into the guidelines.

**Remark** The Zambian experience would appear to be a good one, but from the presentation it appears that contractors (especially the small scale ones) have not been involved in the procurement process. There is a need for transparency in the procurement process, which can be achieved by involving all concerned parties, including local councils. This should be done right from the start of the procurement process. In the case of local councils, it was reported that they were adequately involved in the process.

**Remark** From the general experience with procurement, it appears that too often, too much attention is paid to responsiveness of suppliers and completing the procurement process in time, at the expense of specifications. This has often led to losing out on quality. However, in the case of the Zambian project, it was reported that sufficient time was given to specifications, in fact, more than to any other aspect of the procurement process.

**Remark** Another consideration is the need for research, to avoid being restricted to what is currently available in the market.

**Remark** Poor communication has a bearing on procurement. We should, however, not lose track of the importance of specifications, whatever the communication problems.



**Remark** Development of appropriate equipment requires prototypes. However, the argument of financial constraints and time limitations is often advanced against the development of prototypes. In the case of Zambia, equipment was simply bought off the shelf. The question therefore is, when will it be the right time to start developing appropriate equipment, especially if we wish to promote the local industry?

**Remark** In Kenya, attempts to manufacture appropriate equipment locally are already being made. The tractor trailer, for example, has been manufactured to required specifications. The manufacturer was able to follow up his products on site. In so doing, some problems, including hitching faults, were identified and rectified. With the Kenyan-made motor grader, it was reported that it had been tested by the Kisii Training Centre. It was also currently being used by contractors in a project financed by the Canadian International Development Agency (CIDA). The grader has covered several hundred kilometres of road without any problems. (Participants will be able to view the various pieces of equipment fabricated in Kenya during the field visit.)

**Question** *How long does the procurement process normally take?*

Up to two years. This project achieved a record of six months.

**Question** *What impact has the pilot project had on the sustainability of the procurement process?*

The training provided by the project and the experience gained by the government and local council officials will be useful in future procurement processes.

**Question** *What was the role of the tender boards?*

The project had the flexibility to go for the best option for procuring specified items, without necessarily using tender boards. However, local tender boards were consulted if and where considered necessary. This mainly took the form of advice from their experience.

#### 5.4 EQUIPMENT PROCUREMENT FOR THE DNEP/DFID FEEDER ROADS PROJECT, MOZAMBIQUE

Rob Geddes, Scott Wilson Kirkpatrick, Zimbabwe

**Question** *What were the major problems in the procurement process and how were they overcome?*

The procurement process has been relatively complicated. Lack of capacity, and bureaucracy at the national and local levels are some of the factors. For example, equipment had to be procured all the way from Britain, even though it was readily available in neighbouring Zimbabwe.

The shipping and delivery routing was another complicating factor. Even if the equipment were procured from Zimbabwe, it would have had to pass through the port of Beira, rather than travel overland.



Delays in the documentation process, because of the large numbers and complexity of descriptions of goods, which had to be translated into Portuguese, was yet another factor. Again, as a result of wrong posting of documents for items imported from Zimbabwe, as well as the insistence on using only government clearing agents, some equipment is still lying at the port of Beira one year later.

Overall, the problem may be summarised as an apparent lack of capacity (local) and possibly a lack of technical know-how, as well as a highhanded bureaucracy. There is also the problem of the long distances to be traversed overland, involving border crossings and the threat of landmines.

Some of these problems were countered by employing in-house procurement, the use of consultants and the involvement of the Government Administrator in the clearing of goods. The use of strong local project management also helped to counter the bureaucracy.

**Question** *Why procure all the way from Britain rather than a nearby country?*

Procurement is subject to 'project ideology'. Some locally made products, *i.e.* those from Zimbabwe, are excellent, but were available at double the price of those from Britain. Projects operate on a fixed budget and therefore price considerations become important. Also, given that projects have a limited project life span, the quickest and cheapest methods are often preferred in the procurement process. Again, local procurement is fraught with bureaucracy and its own complications.

**Question** *Sourcing of equipment locally is a good idea. Has adapting available equipment to labour-based works been attempted in Mozambique?*

In Mozambique, local manufacturers have been used to manufacture tractor trailers, which have so far performed well. Also, modifications to some equipment have been attempted with good results.

It was, however, observed that attitudinal problems still exist in respect of locally made equipment. A case in point: people with formal engineering training, which is based on high-tech equipment, are likely to consider locally manufactured equipment sub-standard.

## 5.5 MOBILISING THE PRIVATE SECTOR TO ENGAGE IN LABOUR-BASED INFRASTRUCTURE WORKS — A SOUTH AFRICAN PERSPECTIVE

Ron Watermeyer, Soderlund and Schutte Inc., Consulting Engineers, Johannesburg, South Africa

**Remark** A supportive policy environment is necessary in the whole range of activities related to labour-based technologies, private sector involvement, procurement, contracting, *etc.*, as seen in the South African case. Namibia, like South Africa, has also formulated a Green Paper spelling out how to maximise the labour input in infrastructure



works. In Uganda as well, a project is currently being executed to help formulate conducive policies for labour-based works. Other African countries are encouraged to develop policies to support their commitment to labour-based technology.

**Remark** South Africa's procurement system would appear to be quite rigorous and involved. However, in Uganda, the level of literacy for many contractors would tend to limit the applicability of such a system.

**Remark** Daily testing of materials (as is the case in South Africa) is a useful practice that, if adopted in Uganda, will enable contractors to gain the necessary experience, which currently is still limited.

**Remark** It was observed that the presentation did not adequately define issues relating to involvement of contractors in procurement. Secondly, tools, specifications and health hazards seem not to have been well covered in the presentation. It was further observed that the paper did not deal with the issue of financial management.

**Remark** On the classification of contractors, some people maintained that classification of contractors (to match works to be undertaken and by equipment holding) is necessary to ensure that small scale enterprises are not excluded from labour-based works contracts. Others observed that classification of contractors and the application of fixed rates is counter-productive to their growth and development. They should be subject to competitive bidding right from the start.

**Question** *Isn't the need to provide a performance bond likely to lead to the exclusion of micro-enterprises from winning contracts?*

In South Africa, a system of variation in percentage of performance bonds is applied, depending on the classification of enterprises and contracts. The micro-enterprises are usually not required to provide performance bonds.

**Question** *Is specifying the tools to be employed by contractors really necessary?*

Specifying tools to be used by contractors is not necessary. Contractors should be allowed to choose their own tools. After all, they are risk-takers whose decisions are guided by the need to make a profit and stay in business.

While the need for specifications has been much hyped, we should also consider allowing the development of 'own' specifications for tools and equipment. This would appear to encourage innovation in the tool manufacturing industry. Nationally derived standards and specifications, on the other hand, have a tendency to lock out innovations.

**Remark** South Africa is atypical of other African countries. It is a high-wage economy and has the advantage of being able to finance most of its projects. As such, it can specify whatever procurement systems it deems fit. Other African countries, because of dependence on foreign funding, do not have the leverage to specify which system of



procurement is used. The World Bank, for example, tends to set standards that do not favour local companies, contractors or goods.

**Question** *What are the chances for an ordinary poor South African wishing to become a labour-based works contractor?*

Given its past history, and the emergence of a new era, South Africans are apparently more willing to put aside their differences and are striving to work together. The race/colour issue is not important.

**Question** *Can partnerships and joint ventures with established contractors benefit local small scale contractors?*

As much as 60 per cent of capital is often locked up in joint ventures. Some partnerships are more imaginary than active. It was noted that classification of contractors becomes complicated where partnerships are concerned.

## 5.6 CHOICE OF HAULAGE EQUIPMENT FOR LABOUR-BASED WORKS

Walter Illi and Bruno Illi, Norconsult, Kenya

### Cost comparisons

**Remark** There is a need to revisit methods of calculating haulage costs for each equipment type. Mules and ox-drawn carts are important in mountainous terrain and should be considered in haulage cost calculations. Practical cost comparisons of different methods of labour-based haulage are necessary. Specifically, there is a need to carry out cost comparisons between tractor-trailers and trucks. In so doing, differences in conditions such as terrain, climate, *etc.*, should be taken into consideration. Other economic factors such as capacity of equipment and procurement costs should also be investigated.

Interest rates on trucks need to be considered in haulage cost calculations, particularly as interest rates vary from country to country.

### Loading/Unloading

**Remark** It was generally observed that trucks are hostile to hand-loading, but if equipped with a tipping mechanism, this facilitates off-loading. Tractors, on the other hand, are more easily loaded by hand and have the advantage of being able to leave the trailer being loaded/unloaded, while the tractor itself is deployed elsewhere. However, there is still a need to carry out practical cost comparisons between tractor-trailer combinations and trucks, considering such aspects as utilisation rate and availability.

**Question** *The paper has covered the issue of haulage. What about loading?*



Costs for loading are excluded from haulage calculations. It was noted that loading aspects should be considered when assessing haulage options.

### Tipping trailers

**Remark** It was generally agreed that traditional hydraulic tipping trailers were not durable and that the tipping mechanism has tended to pose problems during operations. This is the case in most counties. In Kenya, manual tipping trailers have been used with reasonable success, although some problems were experienced when dealing with wet material. The tipping angle was not adequate and restricted off-loading. Further research is required.

### Other haulage options

**Remark** Suggestions for new options such as tractor-drawn scoops were given. The scoops, which are small bucket-like items, have a capacity from 1.7m<sup>3</sup> to 2.4m<sup>3</sup> each and eliminate the need for loading and unloading. This method is reported to have been tried in Zimbabwe for dam construction and is suitable for loose or soft material and scooping distances of about 30m. The haulage rate is controlled by the speed of the tractor, but two or more scoops can be used in tandem. In addition, with the scoops, less labour is required for spreading. However, the downside is that a 2.4m<sup>3</sup> scoop needs at least an 80hp 4WD tractor to haul it.

It was observed that the idea of scoops is worth trying, but it should also be subjected to cost comparisons with the old methods of haulage. It was noted that one manufacturer in Zimbabwe is willing to experiment on labour-based projects.

**Remark** Dumping ox-drawn carts were also mentioned as a viable user friendly option.



## 5.7 AGRICULTURAL TRACTORS IN ROADWORKS — A SLIDE SHOW

Rob Petts, MART, UK

**Remark** It was generally agreed that heavy equipment methods are non-viable and cannot be sustained in many Sub-Saharan African countries. However, in many countries, there is a general lack of awareness of the parameters to be considered. Emphasis has mainly been on operational costs, while economic costs, such as depreciation, tend to be ignored.

Hopefully, the tests and studies planned by MART will help draw reasoned and practical conclusions to some of these concerns. There is a need to further strengthen the collaboration between MART, ILO, universities, training institutions, and other concerned parties in this field.

**Remark** In many rural areas across Africa, infrastructure and community services are maintained using tractors. However, it was observed that not all tractors are suitable for roadworks. Availability is one thing; locating the right type of tractor for labour-based roadworks is another. Besides, for labour-based works, it has always been assumed that heavy equipment is not appropriate. The question however is, how would one categorise a 100hp tractor? Is it light or heavy?

**Question** *If labour-based contractors are restricted to light equipment, how are they expected to progress to works that require heavy equipment, especially when donors withdraw, since they will not have acquired either capacity or know-how?*

Before any investment is made, a critical analysis of the local situation for other income opportunities is necessary. Contractors should select equipment that guarantees a payback. Nevertheless, it was also argued that allowing contractors to own equipment beyond the light/intermediate category, such as tippers, would be useful as such equipment could be deployed to other uses besides roadworks. The issue of increasing utilisation rates so as to reduce hire rates of equipment should be considered.

In making the choice of a particular tractor, contractors have to take into consideration a number of issues. Versatility, for example, depends on the size of tractor. The larger tractors generally tend to offer more versatility. A larger tractor therefore would offer contractors more flexibility in the work available to them. Agricultural tractors are becoming increasingly larger, in response to the demands of the sector. Again, critical analysis of the local situation is necessary prior to investing in a particular size of tractor.

**Remark** There is a need for further research into the use of equipment. For example, tractors provide pulling and pushing forces for different types of roller in the compaction process. The merits and demerits of rollers such as dead-weight, sheeps-foot, and ribbed should also be the subject of research.



**Remark** The agricultural tractor has so far been observed to offer many advantages. It is capable of working across sectors, *e.g.* agriculture and roads. It has also proved successful in urban roadworks in Britain.

**Remark** It was noted that even if contracting options for maintenance are fully adopted, the need for governments to retain the capacity to respond in cases of emergency will warrant that some equipment is at their disposal. The agricultural tractor could come in handy in this regard.

**Question** *From the demonstration of tractors in operation on urban roadworks in Britain, it is evident that small tractors have a good potential for labour-based maintenance. The question, however, is why is emulsion being used instead of tar in the recycled bitumen base?*

Emulsion is used mainly because it is readily available in Britain. Also, the temperature conditions favour its use.

## 5.8 REHABILITATING AND MAINTAINING SURFACED ROADS

A O Bergh, P J Hendricks and I Cassiem, Division of Roads and Transport Technology, CSIR, South Africa

**Remark** It was observed that successful labour-based roadworks are dependent on careful planning, selection and position of material used.

**Remark** Labour-based techniques of road construction are particularly useful in the context of built-up townships. As much as possible, this practice should be encouraged and adopted for major road construction as well. Labour-based methods allow for minimal disruption of traffic.

**Question** *How cost-effective is the methodology employed by the programme?*

The issue of cost-effectiveness is very important. However, because this is largely a training programme, more emphasis is laid on the quality of the finished road than on cost-effectiveness.

**Question** *How long after application of the slurry is traffic allowed to pass on the roads?*

The slurry can be damaged if traffic is allowed onto the road too soon. Depending on weather conditions, roads are opened to traffic within four to 24 hours, depending on traffic density. Usually, a cover of crusher dust is applied to speed up the drying process. The dust is swept off after drying.

**Question** *Did you consider the use of various seals?*

Yes. Various seals were tested under different local conditions, prior to selection of the particular type to be used on different sections of the roads.

**Question** *Is the pilot project only for training students?*





The training programme involves implementation of actual roadworks. The methodology applied is described in a series of manuals and the works executed are documented accordingly.

**Question** *Where there is access to plant is this still a cost-effective option?*

It depends on the location and cost of labour.

## 5.9 LABOUR-BASED SURFACED ROAD AND CANAL CONSTRUCTION WITH GEO-CELLS

Paul Malopa, Hyson-Cells, Muldersdrif, South Africa

**Question** *Are Hyson-Cells applicable to loose sand materials, such as are commonly found in parts of some countries, e.g. Botswana and Zimbabwe?*

Hyson-Cells have been found to be applicable in difficult and unstable soil formations. Therefore they are likely to be applicable with loose/sandy materials as well. It would be necessary to consult an engineer to establish this.

**Question** *In applying concrete to the Hyson-Cells, how is the cracking of the slabs prevented?*

As long as the cells are not overfilled, cracking should not occur. The little cracking which sometimes takes place along the joints of concrete slabs is not a problem. In case a concrete finish is required at the top, there is no need for expansion joints, since the plastic walls are capable of this function. Also, water from below is allowed to come up by way of capillary action via the cell wall spacing provided by the cell structure.

**Question** *If, after applying concrete to the Hyson-Cells, something goes wrong, will it not prove very costly?*

Proper application is important to ensure positive results. Engineering input is critical for the success of the process.

**Question** *How much does it cost?*

The current cost per square metre for procurement and laying of Hyson-Cells is at South African Rand 11.50. The company manufacturing the cells reported that they could be in position to assist clients with costing a project, if requested. As for output, it was reported that up to 250m<sup>2</sup> can be laid per day.

**Question** *How is the membrane structure arranged? Is there a bottom?*

The membrane structure is four sided without a bottom. The standard sheets are 7m x 30m, but can be shortened or elongated where necessary. For roadwork, a thickness of 150mm in-situ compaction is required before laying the cells.

**Question** *How is cell collapse avoided during the course of pouring material?*



The cells are anchored to the ground using steel rods and are prevented from collapsing by means of strings that maintain tension within them.

## 5.10 APPROPRIATE HANDTOOLS FOR LABOUR-BASED ROADWORKS

Gary Taylor, IT Transport Ltd., UK

### Handtools management

**Remark** It was observed that, in many Sub-Saharan African countries (and also as observed during the field visit), handtools management on site is generally poor. Incorrect tool usage is prevalent, *i.e.* the wrong tools are used to perform various tasks. Lack of maintenance, and the use of worn-out tools has also been observed. There is a need to emphasise proper management of handtools on site, involving all parties concerned (government, contractors and workers).

**Remark** Correct choice of appropriate handtools for various tasks is essential. A number of the tools traditionally used to carry out certain tasks are inappropriate. For example, the use of the pickaxe for loose soils instead of mattocks or hoes. It is necessary to introduce new handtools that improve productivity. Contractors and workers need training on correct tool usage.

Maintenance of handtools on site is minimal. Certain maintenance activities can be carried out by a local blacksmith on site, for example, sharpening worn pick axes.

Regular replacement of handtools is advisable. Used tools may be sold second-hand for use in the agricultural sector. This enables part of the capital investment to be recouped.

The relatively small increase in productivity does not provide an incentive for the regular replacement of handtools. An alternative would be to sell used handtools for use in the agricultural sector, to recover a percentage of the cost, and then to purchase new tools.

### Tool quality

**Remark** The issue of poor quality tools was again partly attributed to inadequate specifications, poor procurement systems, lack of awareness, as well as poor planning. Even where specifications exist, it was observed that they are often not enforced. On the other hand, it was suggested that procurement systems are a long term problem and are difficult to change in the short run.

Good quality tools, it was argued, may have a limited impact on force account operations, but for a contractor, good quality tools has a major impact. The need to educate contractors about the benefits of good quality handtools — such as increased productivity and increased profits (because of increased time savings and reduced overheads) — was again voiced. Besides, good handtools can result in improved worker morale and reduced injury.



**Remark** It was observed that handtools have not received as much attention as equipment. There is still a lack of awareness, non-availability of good quality handtools in local markets, and procurement difficulties to be overcome. However, replacement and procurement of new (better) handtools is expensive and as such has to be justified through increased productivity. The benefits in terms of increased productivity should accrue to all parties. For governments, there are potential savings from the application of quality tools. For the contractor, there is the opportunity to reap more profits.

**Remark** Sometimes, the proper choice of tools is hampered by the insistence of some workers on using traditional tools. The workers' fears of exploitation because of better tools should be allayed, and they should be made to understand that good quality handtools enable them to accomplish tasks quicker, with less risk of injury. The time saved on one task by a worker can be used on other things or to take on more tasks. This is beneficial to the worker where either task rates or piecework systems are applicable.

### **Productivity and task rate system**

**Remark** It was noted that the task rate system does not necessarily encourage productivity as the tasks are pre-defined and therefore good quality handtools were not a paramount concern of the contractors. Also, the contractors are not motivated to increase productivity as they are in no hurry to complete their contracts as they are not guaranteed further work. For these reasons it would therefore be necessary to educate the contractors that better tools would result in higher worker morale and tasks being completed in a shorter time. This would enable further tasks to be assigned, which would result in shorter project completion time and lower overheads.

For the worker who may be afraid that the tasks set may be increased if better tools are provided, they should be educated that better handtools would not result in an increase in the task set. On the contrary, the provision of better tools would result in faster completion time and lower risk of injury and exhaustion. This would leave him better able to carry out further tasks, either on the road site or on other income generating or domestic tasks.

For the government (client), higher productivity results in a higher number of kilometres of road constructed or maintained.

**Remark** It is important to show both the worker, contractor and the client (government) the benefits of improved handtools. It was suggested that an illustrated brochure be produced illustrating the benefits. This could be distributed to labour-based projects and manufacturers.

**Remark** It was observed that the productivity of a large labour force tends to be low at the beginning, but increases as a rhythm sets in.



### Task rate versus piecework

**Remark** It was noted that there is scope for both systems depending on the prevailing local conditions. In situations where workers have other non-roadwork-related activities to perform, such as agricultural activities, the task rate system is preferred. The piecework system, though advantageous to the worker, poses the risk of self exploitation, where the worker pushes himself to complete more tasks. This also carries the risk of lowering the quality of the work as the worker gets tired. When the piecework system is adopted, the contractor must exercise control over the number of tasks a worker can perform in a day. The piecework system has also been used as a bonus system in the task rate system, where extra tasks are assigned when the initial task is completed.

**Remark** In the case of task rates, when dealing with a large labour force, productivity may initially be low, before the labour force picks up in rhythm. Various tasks performed earlier set the precedent for later tasks. Productivity will tend to increase as a rhythm sets in. An intermediate system equates task work to basic pay, and thereafter the worker may be given the option of piecework if he so wishes.

**Remark** In conclusion, it appeared that both systems still have scope, depending on the prevailing situation. Besides, it is necessary to let contractors choose freely the system they prefer, otherwise it will appear as if undue restrictions are being imposed on the private sector. However, there is a need for training of contractors on the productivity factors. Further study of the two methods is also required.

### Hand tool management experience in Kenya

**Remark** On a project in Kenya, Norconsult promoted the initiative for contractors to produce handtools, *e.g.* handles, wheelbarrows, culvert moulds. The contractors were also shown how to maintain tools, *e.g.* sharpening and simple repairs. This resulted in slightly higher standards for the tools on site.

**Question** *Are there moral issues being overlooked in this presentation?*

In Ghana, for example, there was a case in which the contractor did not fulfil his obligation to provide handtools. Instead, workers had to bring their own tools.

In the fulfilment of obligations, *i.e.* by client, contractor and workers, it was observed that sometimes workers ended up becoming victims. It is necessary that each party fulfils its part of the bargain, *e.g.* contractors supply the right tools and ensure prompt payment. Good business practice on the part of contractors is called for. Matters such as exploitation of workers should be looked at, without de-motivating the private sector through undue restrictions.



**Question** *What role does protective clothing play in the productivity equation and what is the view of the ILO on the use of protective clothing?*

The ILO encourages the provision of protective clothing. However, it was noted that, in some places, weather conditions, *etc.* dictate what should be worn by workers. Where deemed necessary clothing specifications could be included in the contract.

It was also noted that in cases where the labour force is temporary it would be impracticable to provide all labourers with protective clothing.

However, although adoption of standards for clothing is seen as a way forward, based on the Kenyan experience, implementing it is difficult. Complaints from clothing manufacturers resulted in the relaxation of set standards. However, the question of the relationship between protective clothing and productivity needs further study.

#### **Ghanaian trial results on productivity**

**Remark** Trials conducted in Ghana by the University of Science and Technology on both the effect of the origin of workers, *i.e.* local or imported labour, and the effect of the quality of handtools, on productivity (where productivity was defined as the amount of work done per day) indicated that productivity was not affected by either of these factors. However, when productivity was defined as output per hour, there were significant differences. The imported labour showed a higher output per hour.

However, although contractors had the option of increasing their output through employing good quality tools, this was not practised. The reason advanced by the contractors was that they had a large monthly wage bill and there was a time lag between completion of tasks and effecting of payments of certificates. Furthermore, the contractor had no incentive to hurry his job since he first needed assurances of the next job; otherwise, he would be taking the risk of losing his workers.



## 5.11 HANDTOOLS IN THE URBAN INFRASTRUCTURE PROJECT, ADDIS ABABA

Tesfaye Kunbi, CARE, Addis Ababa, Ethiopia

**Remark** It was observed that the project's experience was useful in highlighting the unique problems of applying labour-based technology in urban settings.

**Question** *How did the project involve the city authorities and the populations?*

The project recognised that involvement of committees is a good practice, given that there are often inherent difficulties associated with urban populations and municipal or city councils. Some of the problems were resolved through involving the city authorities and the beneficiary communities in both project design and implementation. A clear definition of roles and responsibilities of each partner was made.

**Question** *Given the level of poverty in the communities, how are they able to contribute the 10 per cent requirement?*

Community contribution towards the maintenance fund has not been a problem. It represents only ten US cents per month, which is generally affordable.

**Question** *How did the project get equipment?*

Construction machinery for project activities is owned and lent to the project by the City Council as part of its obligation. The project only purchased handtools.

**Question** *How did the project deal with protective clothing?*

Although the need for protective clothing due to unsanitary conditions was recognised, the project's resources were limited and did not permit indulgence in protective clothing.

On the issue of land ownership and title deeds, it was noted that land in Ethiopia is owned by the government.

## 5.12 DEMONSTRATION OF SOIL TESTING EQUIPMENT

Mike Vlok, CSIR, South Africa

**Question** *While the CSIR should be commended for developing the test kit, it was noted that selection of the right material, i.e. the correct properties of the soil, is paramount in roadworks. If the apparatus cannot be used in determining the CBR of the compacted layers, the question remains how useful is the apparatus?*

The equipment is primarily designed for the technicians in the field, who would like a rapid assessment of the materials in order to make a quick decision on whether to go ahead or not.



The RCCD can measure shear strength up to a depth of 85mm. It measures the top section only, but it provides a useful rapid assessment.

Aggregate strength is measured by the Treton apparatus. The acceptable Treton Impact Value should be between 20 and 65.

**Question** *Is it possible for this apparatus to be manufactured outside CSIR?*

There are no plans as yet to manufacture the kit outside South Africa, because the CSIR cannot guarantee quality of workmanship. While some components are quite easy to fabricate or are available off-the-shelf, the trigger mechanism requires a high degree of precision.

**Question** *After how long a period should the spring mechanism be re-calibrated?*

The initial recommendation is to recalibrate every year, but in actual practice recalibration should be based on usage. Experience so far has shown that the springs on RCCDs used for four years were found not to require calibration. What actually wears out is the tip, hence provision of extra tips is necessary.

**Question** *How do the test results of this equipment compare with more conventional methods and set standards?*

The results so far appear to compare quite well with established laboratory or standard tests. However, it should be emphasised here that the kit is for use in the field (on site), mainly in order to determine quickly whether to go on or not.

**Question** *Is the test for dry or wet material?*

It depends on the test being carried out. For example, for material grading (sieve analysis) dry materials are recommended.

**Question** *Can the kit determine plasticity?*

The Plasticity Index is not measured directly using this kit, but indicators for plasticity can be determined.

Concern was raised on the risk of over-simplification of tests and loss of accuracy due to failure of the equipment, *e.g.* the spring. This raised the question of whether there are correlation graphs and tables to enable comparison with standard specifications.

The RCCD spring is very durable and the failure rate is low. There have been tests and the results are accurate.

**Remark** It was suggested that an annex which relates the kit to conventional equipment, *i.e.* the correlation between the kit results and laboratory results, be included in the manual.

**Remark** In response to the issue of correlations, it was emphasised again that the gravel road test kit is meant for quick analysis in the field. Under field conditions, there is no power source or time to waste with detailed analysis. Besides, since ideal gravel material is



becoming increasingly rare, there is a need to quickly test available material and determine most suitable alternatives.

**Question** *What are the costs for the each of the kit's three options?*

Option 1: Full Kit, US\$2500

Option 2: Without a DCP, US\$2200

Option 3: Soil testing kit only, US\$2100.

### 5.13 COMPACTION FOR GRAVEL ROADS, TRACKS AND EMBANKMENTS

Tony Greening, Transport Research Laboratory, Zimbabwe

**Remark** Although it is generally known that compaction is an important determinant of the durability of a road surface, experience has shown that not enough attention is given to compaction. This observation was exemplified during the field visit to the Uganda Transport Rehabilitation Project (UTRP) project in Eastern Uganda. At the roadworks sites, the application of moisture obviously appeared to have been given little or no attention at all.

**Remark** It was observed that, in many projects, water bowsers are used for watering roads. However, in some places, water is far-off and the cost of delivering it to site tends to be high. The question in such cases is, should we wait till the rains come?

**Remark** The use of water bowsers could be wasteful in some places due to high evaporation rates. The time lag between sprinkling and compaction is sometimes long and this leads to substantial moisture loss through evaporation. In such cases it is suggested that the material be sprayed at source with water overnight, and then be transported to the site in the morning. It was however, observed that this method is not applicable in the case of roads that do not require gravel. Overall, the suggested method appears to be even more costly since, for example, wet material is heavier.

**Question** *What is the necessary amount of compaction?*

The amount of compaction will depend on the standard of the road based on the level of traffic. Generally, attempts should be made to achieve 85 per cent compaction. In the case of labour-based roads, the question however is, should we relax standards and risk our roads being called sub-standard? There is a need to include and define compaction standards as part of labour-based contracts. In Zambia, for example, laboratory tests are to be revived to enhance compaction tests and to ensure control over contractors.

**Question** *How much should compaction be allowed to cost? What is the economically viable level for compaction?*

This question can best be answered by carrying out deterioration tests. These will help determine how much is either gained or lost through compaction. Avoiding compaction now means higher maintenance costs later.





**Question** *Given the dry conditions in most of Africa and inaccessible water supply, is dry compaction a viable option?*

For most of Africa, dry conditions may dictate that dry compaction methods be explored. There is a need to carry out research on this aspect as well as on the type of equipment that will be adequate for dry compaction.

**Remark** In some places, it is extremely difficult for labour-based works to achieve correct compaction, *e.g.* the Kalahari soils of Zimbabwe, which are very difficult to compact in the dry season. At the same time, it is not practicable to ask contractors to wait for the rains before they attempt compaction. Overall experience from Zimbabwe has shown that compaction at correct water/moisture levels is very difficult to achieve.

**Question** *Gravel is becoming more and more scarce. Is the use of chemical soil stabilisers a viable option for African countries?*

The cost issue is important. Studies are yet to be undertaken to determine the various cost options for dry or wet compaction, soil stabilisation, *etc.* Cost-effectiveness studies for compacted and non-compacted roads are necessary. The options should be studied in the context of labour-based works. In addition, with chemical stabilisation there are environmental considerations (for example, soils may become toxic), as well as other environmental hazards. A possible solution would be to use dilute concentrations together with some compaction.

## 5.14 INFORMATION TECHNOLOGY DEVELOPMENTS

David Mason, ILO/ASIST, Nairobi, Kenya

**Question** *By a show of hands, how many of you (participants — of whom there are about 100 in the room) have access to:*

A Personal Computer? (Answer 52)

A PC with a CD-ROM drive? (Answer 25)

Email? (Answer 41)

**Question** *By a show of hands, how many of you:*

Have heard of the Internet? (All)

Know what the Internet is? (Answer 43)

Are connected to email? (Answer 14)

**Remark** The ASIST bibliographic database on diskette, ASISTDOC, is available for sale at US\$ 25 for a year's subscription. Demonstrations of the database were available during the period of the seminar.

**Question** *How much of the ASIST database is now in electronic form on the Web site?*



ASIST has commissioned the CSIR of South Africa to convert ASISTDOC to a form which is accessible through the Web site. This contract includes adding up to 3000 pages' worth of full text documents to the site. So far, all the ASIST Bulletins and Regional Seminar Proceedings are available in electronic form. Whilst the Web site is functional, one may not be able to gain access to all the information available at the moment because the whole system is still under development.

### 5.15 CONSIDERATIONS FOR THE DESIGN OF TOOLS FOR LABOUR-ENHANCED ROAD CONSTRUCTION AND MAINTENANCE

Crispin Pemberton-Pigot, New-Dawn Engineering, Manzini, Swaziland

**Question** *Although emphasis is placed here on the need for labour-based works, what should be done where some people or communities are averse to manual labour?*

The assertion that people do not want to work is false. What is lacking is motivation. This reinforces the fact that human considerations (ergonomics) must be incorporated at all stages of tool design. Issues such as appropriate rest periods and their regulation should be considered in the design of tools.

**Remark** On the issue of little research in Africa on tools and equipment, it was observed that this was not absolutely true. On the contrary, reasonably good input has gone into research in different countries.

**Remark** The need for interaction between tool manufacturers and the client was observed to be important, as it ensures that a client's needs are met by the tool design. New Dawn Engineering was requested to get in touch with projects. The rock crusher, for example, was observed to be very useful. Its applicability and ease of use, as demonstrated, add to its appeal. This technology should actually be exported.

**Question** *Given other technologies for stone crushing from other countries (mainly developed), how competitive is New Dawn Engineering's stone crusher?*

The crusher from New Dawn Engineering was reported as being competitive and cost-effective. Tools should, as a matter of principle, be designed to withstand human abuse. However, 'foolproof' tools often tend to be bulky, heavy and difficult to use.

**Question** *Is New Dawn Engineering attempting to maximise sales of its products rather than knowledge of its design?*

It is not true that New Dawn Engineering is only interested in marketing of the product. It also attempts to make scientific knowledge about the products available.



**Question** *Is there a difference in the output produced by men and women?*

It is known that men and women generate 100 and 80 watts of output per unit respectively. The question therefore is, should men be paid at higher rates? Gender issues in respect of labour-based works require further study before conclusions on this subject are drawn.

**Question** *How long and how much did it cost to develop the stone crusher?*

It took up to one and a half years, at a cost of approximately US\$2000.

**Question** *Does New Dawn Engineering manufacture other labour-based products?*

New Dawn Engineering is developing other tools and equipment apart from the stone crusher. However, due to limited resources, it is not presently possible to carry out all the necessary experiments, research, *etc.* Development of prototypes is very expensive (about seven times the retail price of the product). Without financing from other sources, it is difficult to develop many new products.

## 5.16 THE FIT PROGRAMME EXPERIENCE

Enock Mbeine, FIT, Uganda

A brief overview of the FIT programme was presented. FIT is a technical assistance programme implemented through the ILO in Geneva. The FIT programme has been working in Kenya and Ghana for over three years. It aims to develop innovative new approaches to development and delivery of non-financial business services to micro and small-scale enterprises (MSEs) exclusive of financial assistance.

From the Kenyan and Ghanaian experiences, FIT has developed a number of effective mechanisms for providing new and improved services and is now in the process of disseminating these to six other countries. In Uganda, the programme started in February 1997.

User Led Innovation (ULI) activities developed by the programme are being introduced through a series of workshops and meetings. In these, participants are taken through the process of design of new and improved products as suggested by potential customers. The main advantages are feedback on the performance of new products and incorporation of local knowledge into technological solutions. ULI can be applied to a variety of sectors, and would therefore benefit the tool manufacturing industry, be it local or international.

**Question** *What problems are encountered in matching the demands and the needs of the manufacturers with those of the end users?*

Through the FIT programme, it is possible to mobilise the manufacturers and end users. This is likely to result in a compromise solution favouring both the manufacturers and the end users. With



time, the process could lead to mass production, which benefits all parties.

## 5.17 SOCIAL FUND FOR DEVELOPMENT (GOVERNMENT OF EGYPT)

Abdallah El-Feki, Social Fund for Development, Egypt

This presentation on the Social Fund for Development (SFD) mainly highlighted some aspects related to the implementation of the programme. The programme was established in 1991 with the main objectives of creating job opportunities, reducing the adverse effects of economic reforms and encouraging manpower to return from the Gulf Region. The first phase, 1991-1996, with a total budget of US\$600 million from 17 donors, targeted the following programmes:

- Public works, at US\$180 million, implemented through labour-based methods, in which 25 per cent of the budget was direct labour wages
- Community development programme, at US\$100 million, targeted mainly at women and children, including income generation
- Small enterprise development, at US\$400 million, which mainly involved loans to unemployed youth
- Labour mobility, at US\$50 million
- Institution development programme, at US\$40 million.

In all, over 600 000 jobs were created in Phase I. Phase II is to be implemented at a total cost of US\$700 million, as a result of the success of Phase I. The project was rated best among 30 implementing countries by the World Bank's President during his visit to Egypt in 1996.

**Question** *What guarantees are required for the loans given to the youth?*

The programme endeavours to recover monies loaned to the youth by holding on to some of the assets till loans are fully paid. Collateral is mainly in the form of recommendations from relatives who guarantee to back up the youth. Further, continuous supervision of the loan enterprise is done to ensure non-laxity. So far, the loan recovery rate is 92 per cent. Measures have been instituted to help those who have not been able to repay their loans.

## 5.18 MOZAMBIQUE — EXPERIENCE WITH IBIS

Ragnar Hansen, IBIS, Mozambique

IBIS is an NGO working in Northern Mozambique's Zambezia Province. The presentation highlighted a number of issues in relation to the roads programme implemented by IBIS against a war-ravaged background. Due to the hostile war environment, IBIS activities have had to be limited to the peri-urban areas. In spite of very difficult working conditions (all infrastructure destroyed, danger from



landmines, *etc.*), some achievements have been recorded in rehabilitation and maintenance of roads using labour-based methods.

The project started by patching up the 45km road from the town to the beach, which is the only recreational area. Contracts of up to one kilometre long are awarded. The costs and the profit margins are worked out and fixed by IBIS. A task rate system is employed for the roadworks. This enables the workers to attend to other tasks, such as agriculture, on completion of their respective roadworks tasks. However, in the harvesting and planting seasons, recruitment problems are sometimes encountered.

IBIS has found out that it takes up to two months before workers can work in rhythm. Success is largely dependent on the enthusiasm of the local people. The cost of roads is between US\$3000 and US\$6000 per kilometre. The experience has further highlighted the great need for supervision and training. It was noted that nearly all activities including compaction and stone removal are done by labour. The only equipment used is a tractor and trailer.



## 6 Field visit

### 6.1 INTRODUCTION

A field visit to the Uganda Transport Rehabilitation Project (UTRP) in Eastern Uganda was undertaken on the third day of the workshop. The UTRP covers the districts of Kapchorwa, Mbale, Palissa and Tororo and is financed jointly by the GoU, the four participating districts, the World Bank and the Nordic Development Fund. The project cost is US\$16.5 million over a four-year period ending in the year 2000. The project is carrying out rehabilitation and maintenance of rural feeder roads (RFRs) in the four districts, using labour-based/light equipment supported methods by small-scale local contractors. Technical assistance is provided by Norconsult AS. and Gannet Fleming. The latter is based at the MoLG Headquarters.

Rehabilitation works are being executed by trained local contractors, who have concluded their trial contracts. The local contractors are to be equipped by the project, with a lease period of 48 months and an interest rate of 12 per cent in local currency. The average rehabilitation cost per kilometre is US\$12000.

### 6.2 SITES VISITED

Two contractor-managed sites were visited. At both sites, labour-based rehabilitation works were being executed. The UTRP officials from Mbale (the field headquarters for the project) briefed the delegates on the various activities on each site. The contractors, and the Kenyan manufacturer of some of the equipment, also briefed the participants on various issues. The participants had the opportunity to question the UTRP officials, the contractors, labourers and the Kenyan manufacturer (Trimborn) during the course of the site visits.

The field trip ended with a visit to the Mbale Elgon Training Centre. At the Training Centre, a tour and a briefing on the Centre's activities were conducted. Prior to the last scheduled activity, a sumptuous meal was served. The last activity was an inspection of various pieces of equipment, tools for the labour-based contractors, and a demonstration of the Hyson cells, the Kenyan made tool testing frame, and modified hitching systems.

### 6.3 OBSERVATIONS FROM THE TWO ROAD SITES

#### 6.3.1 Towed grader (Simba)

The tractor-towed grader under demonstration was manufactured in Kenya under licence from Simba UK Ltd. The UTRP engineer in charge of the district made some observations on this equipment as follows.



The towed grader is used for road maintenance. Other works such as mitre drains, ditches, tree stump removal, *etc.* are done first by labour before applying the towed grader. This is done to ensure that as low a load as possible is applied. The towed grader's blade cannot be extended sideways. Therefore activities such as widening side slopes and drains are done manually. The towed grader is more suitable for light soils, such as those found in two of the project districts, Tororo and Palissa. In the case of Kapchorwa and Mbale districts, which are mountainous and where the soils are heavier, the towed grader is not recommended. Even if it is fitted with a ripper, the type of soil restricts its operations. It is therefore the practice to concentrate activities during the rainy season. The towed grader requires harmony between the two operators to work well. It has the advantage of being easily unhitchable allowing other accessories to be hitched to the tractor, *e.g.* water bowser, trailers, *etc.*

### **6.3.2 Light motorised grader**

The light motorised grader, going by the name of Agritrac Motor Grader 90, was observed in action. It is manufactured in Kenya by a private company called Trimborn Agricultural Engineering Ltd. According to the manufacturer, the Agritrac 90 provides high productivity with low maintenance costs. The reconditioned Deutz engine, used in many agricultural machines, allows for compatibility of spare parts. It is capable of grading three kilometres per day at a hire charge of US\$35 per hour. The capital cost is between US\$65 000 and US\$70 000, depending on the type. Detailed specifications were provided in the brochure that was distributed. The machine has been tested in different parts of Kenya and has so far registered good performance. The light motorised grader has a simplified design to reduce the inherent problems associated with sophisticated imported machines.

### **6.3.3 Interview with the contractor**

The contractor on site reported that he had undergone training on a trial contract, completed an interim contract and was now implementing a standard contract. He was ahead of schedule on his assignment by four kilometres. The total contract sum for a 20km contract was US\$222 000. He reported that 2 per cent of his labour force were women, who are given lighter jobs. He was operating a double shift, using task rates.

However, in spite of his apparent success, it was evident that the contractor was employing worn-out handtools. Compaction on site was also observed to be inadequate. Where it was being done, no attempts had been made to add water. The participants were informed that this would be rectified soon. Water bowzers had already arrived in the project area but were awaiting registration before they could be made available to the contractors.



Poor handtool management was seen as a major problem on both sites. The UTRP is however in the process of providing new handtools to the contractors.

#### **6.3.4 Mbale Elgon Training Centre**

The participants were briefed on the Training Centre's activities as follows. The Training Centre was rehabilitated and equipped as part of the UTRP activities. It has accommodation for 40 students, one office, one classroom and a laboratory. Training involves two categories of participants: the clients (District Administrations) and contractors. Some aspects of the training are project-specific while the rest are designed to suit any labour-based roadworks and contracting management system. The programme involves formal training, trial contracts, and development stages. The course is extended to district technical administrative and elected officials. Community leaders are also trained. Other projects are also using the Training Centre for training of their project staff.

At the Training Centre, participants were able to view an exhibition of various teaching materials and modules; reference and reading materials; training calendars; contract documents; and some soil samples.

#### **6.3.5 Exhibited equipment and handtools**

Participants were treated to various demonstrations, including:

- Laying of Hyson cells
- Hand tool testing using the Kenyan, Kisii Training Centre, testing frame
- Culvert manufacture using Kenyan-made culvert moulds
- The modified hitching systems for trailers from Kenya.

Various types of equipment were on display, some purchased by the UTRP project for the contractors and the rest for demonstration purposes. The equipment included:

- Wheelbarrows (a prototype of a new heavy-duty wheelbarrow, from an original design by the Technology Unit of the MoPWH in Kenya, modified by ILO/ASIST, was on show in the main conference hall in Jinja)
- Pedestrian rollers, double drum from BOMAG in Germany
- Vibro-roller, single drum, towed, 2.3 tonne, designed and manufactured by Trimborn, Kenya
- Tractor-drawn non-tipping trailers, 3m<sup>3</sup>, manufactured by Trimborn, Kenya
- Steel culvert moulds, designed by Norconsult and manufactured by Sihra Engineering, Kenya





- Light motorised grader, designed and manufactured by Trimborn, Kenya
- Material strength testing frame, made by Kisii Training Centre, Kenya
- Tractors, Holland and Fiatagric, 80hp
- Water bowsers, manufactured by Trimborn, Kenya
- Concrete mixers
- Tipper trucks, imported from Mitsubishi in Japan.



## 7 Statements of the seminar

In order to be able to derive recommendations and resolutions from the seminar, a select team put together eight statements. The statements were presented to the participants to vote on by show of hands. However, many participants disagreed with the framing of the statements. After some modifications, the following statements were presented.

### 7.1 STATEMENT 1

The market share of road construction and maintenance work done by trained contractors is having a serious impact on any activity related to tools and equipment for labour-based works.

*Agreed: 40                      Disagreed: 6*

There should be special initiatives to ensure that labour-based contractors can access a bigger share of the market in competition with the equipment-based contractors.

*Agreed: All but 8              Disagreed: 8*

### 7.2 STATEMENT 2

Do we accept locally available tools (either locally made or imported but available in the local market) or should we make extra efforts to obtain better quality handtools elsewhere?

*Use locally available: 45*

*Better quality handtools: 39*

### 7.3 STATEMENT 3

We accept that good tool management (appropriate choice of tools, timely maintenance and replacement, correct techniques of use) is an important element in site productivity in roadworks.

*Agreed: All                      Disagreed: 0*

We should involve the following in tool management:

Workers	<i>Agreed: All</i>	<i>Disagreed: 0</i>
Clients	<i>Agreed: 22</i>	<i>Disagreed: 31</i>
Others	<i>Agreed: All</i>	<i>Disagreed: 0</i>

'Others' were defined as: manufacturers, contractors, suppliers, trade unions, national bureau of standards, communities.



#### **7.4 STATEMENT 4**

The use of tractor-towed and light motor graders should be limited to maintenance work only.

*Agreed: 19*

*Disagreed: 35*

#### **7.5 STATEMENT 5**

The cost of different haulage methods should be reassessed. Projects should evaluate the cost-effectiveness of different haulage equipment under the prevailing technical and financial conditions.

*Agreed: 80*

*Disagreed: 2*

#### **7.6 STATEMENT 6**

There should be different compaction strategies and standards for different types of road.

*Agreed: All but 4*

*Disagreed: 0*

*Abstained: 4*

There should be different compaction strategies depending on whether the construction and maintenance works is carried out by force account or contractors.

*Agreed: 19*

*Disagreed: 38*

#### **7.7 STATEMENT 7**

The seminar participants reaffirm their commitment to quality of work and recommend more use of soil testing with early results available to the work sites. Furthermore, test results should be comparable with other commonly accepted testing methods.

*Agreed: 60*

*Disagreed: 1*

#### **7.8 STATEMENT 8**

The seminar participants recognise the huge potential for expanding labour-based technology in urban and rural settings. They therefore recommend that the experience with labour-based tools and equipment in the road sector should be made available for adoption to the extent possible in these other areas.

*Agreed: All*

*Disagreed: 0*



## 8 ANNEXES

### 8.1 ANNEX 1: SIXTH REGIONAL SEMINAR AGENDA

Hotel Triangle, Jinja, Uganda, 29 September - 3 October, 1997

<b>Day 1: Monday 29 September 1997, Jinja</b>	
08:30-10:30	Registration at Hotel Triangle and travel from Kampala for late arrivals
09:00-09:30	Briefing for chairpersons and presenters by David Mason, ILO/ASIST
<b>Opening Ceremony</b>	
<i>Chair</i>	<i>Mr H R Kibuuka, Permanent Secretary, Ministry of Works Transport and Communications, Uganda</i>
10:30-11:00	Welcome Address by Mr Robert Kibuuka, Permanent Secretary, Ministry of Works Transport and Communications, Uganda
11:00-11:30	Opening Address by Hon. Awuzu Andruale, Minister of State for Local Government, Uganda
11:30-12:00	Tea/Coffee Break
<b>Scene Setting</b>	
<i>Chair</i>	<i>Eng. Karuma-Kagyina, Chief Engineer, Ministry of Local Government, Uganda</i>
12:00-12:10	The objectives and agenda of the Seminar by David Mason, ILO/ASIST
12:10-12:35	The ILO and employment-intensive infrastructure policies and practices by Jan de Veen, Development Policies Department, ILO
12:35-13:00	The role of ASIST by Jane Tournée, ILO/ASIST
13:00-14:30	Lunch Break
<b>Presentation of Papers</b>	
<i>Chair</i>	<i>Joseph Mutabazi, Ministry of Works Transport and Communications, Uganda</i>
14:30-15:00	Uganda country paper by Eng. William Musumba, Ministry of Works Transport and Communications, Uganda
15:00-15:20	Discussion on the Uganda country paper
15:20-15:40	MART questionnaire on tools and equipment by Paul Larcher, MART, UK
15:40-16:00	Discussion on the MART questionnaire
16:00-16:30	Tea/Coffee Break



16:30-16:45	Procuring equipment by Alfred Sakwiya, Feeder Roads Project, Ministry of Local Government and Housing, Zambia
16:45-17:00	Discussion on procuring equipment
17:00-17:30	Equipment procurement for the DNEP/DFID Feeder Roads Project, Mozambique by Rob Geddes, Project Advisor, Mozambique
17:30-18:00	Discussion on equipment procurement
19:00-22:00	<b>Cocktail Party at the Hotel Triangle Annex</b>

## **Day 2                      Tuesday 30 September 1997, Jinja**

### **Presentation of Papers**

<i>Chair</i>	<i>Eng. Were-Higyeniyi, Engineer-in-Chief, Ministry of Works Transport and Communications, Uganda</i>
08:30-09:00	Mobilising the private sector to engage in labour-based infrastructure works — a South African perspective by Ron Watermeyer, Soderland and Schutte Inc., South Africa
09:00-10:00	Discussion on mobilising the private sector
10:00-10:30	Equipping trained labour-based contractors — the Ghanaian experience by E N K Ashong, Department of Feeder Roads, Ghana
10:30-11:00	Tea/Coffee Break
<i>Chair</i>	<i>David Mason, Training and Information Services, ILO/ASIST</i>
11:00-11:30	The choice of haulage equipment for labour-based roadworks by Walter Illi, Norconsult, Kenya
11:30-12:00	Discussion on the choice of haulage equipment
12:00-12:30	Agricultural tractors in roadworks by Rob Petts, MART, UK
12:30-13:00	Discussion on agricultural tractors in roadworks
13:00-14:30	Lunch Break
<i>Chair</i>	<i>Eng. Peter Ssebanakitta, Chief Road Maintenance Engineer, Ministry of Works Transport and Communications, Uganda</i>
14:30-15:00	Rehabilitating and maintaining surfaced roads by A O Bergh, South Africa
15:00-15:30	Discussion on rehabilitating and maintaining surfaced roads
15:30-16:00	Tea/Coffee Break
16:00-16:30	Slide show: Labour-based surfaced road and canal construction with Geo Cells by Paul Malapo, Hyson Cells, South Africa
16:30-17:00	Discussion on Hyson Cells
17:00-17:30	Briefing on the Field Trip by Were-Higyeniyi and John Otemo



### **Day 3                      Wednesday 1 October 1997, Mbale**

*Chair*                      *Eng. Were-Higyenyi*

#### **Field Trip to the UTRP Districts**

07:30-08:00              Muster for the Field Trip at Hotel Triangle  
 08:00-10:00              Travel to UTRP Feeder Roads Project, Mbale  
 10:00-13:00              Site visits and introduction to the site by John Otemo, National Project Manager, UTRP

13:00-14:00              Lunch at Mbale Elgon Training Centre

14:00-16:00              Demonstration of tools and equipment  
                                   Exhibition of tools and equipment  
 16:00-18:00              Return to Jinja

### **Day 4                      Thursday 2 October 1997, Jinja**

#### **Presentation of Papers**

*Chair*                      *Mr Collins Antwi, Director, Department of Feeder Roads, Ghana*

08:30-09:00              Appropriate handtools for labour-based roadworks by Gary Taylor, IT Transport, UK  
 09:00-09:30              Discussion on appropriate handtools  
 09:30-10:00              Handtools in urban infrastructure development in Addis Ababa by Tesfaye Kunbi, Care Ethiopia  
 10:00-10:30              Discussion on handtools in urban infrastructure development

10:30-11:00              Tea/Coffee Break

*Chair*                      *Eng. Barnabas Ariga, Principal of KIHABT, Kenya*

11:00-11:30              Demonstration of soils testing equipment by CSIR, South Africa  
 11:30-12:00              Discussion of soils testing equipment  
 12:00-12:30              Compaction of gravel roads, tracks and embankments by Tony Greening, Transport Research Laboratory, Zimbabwe  
 12:30-13:00              Discussion on compaction of gravel roads, tracks and embankments

13:00-14:30              Lunch Break

*Chair*                      *Dr Peter Komba, Chief Engineer, Rural Roads, Ministry of Works, Tanzania*

14:30-15:30              Information technology developments by David Mason, ILO/ASIST  
 15:30-16:00              Discussion on Information technology developments



<i>Chair</i>	<i>G N Mackay, Arthur Garden, Zimbabwe</i>
16:00-16:30	Considerations for the design of tools for labour-enhanced road construction and maintenance by Crispin Pemberton-Pigot, New Dawn Engineering, Swaziland
16:30-17:00	Discussion on the design of tools
17:00-17:20	The FIT Programme in Uganda by Enock Mbeine, Uganda
17:20-17:40	The Social Fund for Development Programme by Abdallah El-Feki, Egypt
17:40-18:00	Mozambique — experience with IBIS by Ragnar Hansen, IBIS, Mozambique

## **Day 5                      Friday 3 October 1997, Jinja**

### **Summary**

<i>Chair</i>	<i>Mr Mutabazi, Ministry of Works Transport and Communications, Uganda</i>
08:30-10:30	Statements of the Seminar by Terje Tessem, ILO/ASIST
10:30-11:30	Tea/Coffee Break

### **Closing Ceremony**

<i>Chair</i>	<i>Eng. Karuma-Kagyina, Chief Engineer, Ministry of Local Government, Uganda</i>
11:30-12:00	Closing speech by Hon. Wanjuzi-Wasieba, Minister of Works Transport and Communications, Uganda
12:00	Departure for Kampala
18:30	<b>Cocktail Party, Nile Hotel Gardens, Kampala</b>



## 8.2 ANNEX 2: OPENING SPEECH

Hon. Eng. Awuzu Andruale, Minister of State For Local Government, Uganda

Mr Chairman, distinguished participants, ladies and gentlemen.

It is indeed my great pleasure and honour to have been invited to open this important seminar which focuses on promoting sound engineering use of labour-based methods in the implementation of infrastructure works.

I am aware that for the next five days you will exchange ideas and experiences, appraise yourselves of new policies and developments and identify and address new issues related to the theme 'The right tool for the job — a review of tools and equipment for labour-based infrastructure works'.

Allow me to add on to what the chairman has said and welcome you warmly to Uganda. The atmosphere here in Uganda is conducive for you to interact and exchange professional ideas in this field, which Government fully supports.

At the outset, let me thank the host, the Ministry of Works Transport and Communications together with the Ministry of Planning and Economic Development, ILO/ASIST and my Ministry for organising the seminar that has enabled you to come together for a common cause.

It is of great importance to the Sub-Saharan region that practitioners of vast professional experience in labour-based works meet to exchange experiences and review developments in labour-based technology.

The use of labour-based methods in the construction and maintenance industry of physical infrastructure facilities is not a new technology. Use of labour as the basis for production has for ages been applied predominantly in the Sub-Saharan Africa region in the construction of feeder and community roads. What is required is that the planning, organisation, management and implementation methods have to be improved upon through research and sharing of experiences.

Indeed, use of labour-based technology, particularly in the rehabilitation of feeder roads, generates employment opportunities, more so to the rural populace. It increases incomes and consequently improves the livelihood of the rural poor. Besides offering direct employment and income, studies have shown that labour-based methods also create indirect employment in other sectors and the multiplier effect is estimated to be in the order of one and a half to two times the direct impact.

In Uganda, just like in other developing countries, the rate of employment creation falls short of the growth of the working-age population. About 3.8 million people out of the estimated labour force of 8.0 million people are either unemployed or underemployed. This means that a wide gap exists between labour supply and demand.





With an annual labour force growth rate of 3.4 per cent, approximately 300 000 new jobs need to be created each year to prevent the employment situation from deteriorating further.

The challenge of creating sustainable livelihoods to particularly the 55 per cent of the population living below the poverty line in the rural areas is therefore enormous. The current labour force component in infrastructure works in Uganda is only about 10 per cent. By doubling the percentage through the use of labour-based methods we would be able to create another 150 000 to 200 000 jobs.

With our limited technology, in order to create more jobs, it is necessary to identify sectors of the economy that offer better prospects for generating a faster pace of job creation. Use of labour-based methods in infrastructure works is therefore seen as one of the few and limited ways of achieving this objective.

At this juncture, allow me to share with you the experiences of Uganda, particularly in the use of labour-based methods in the rehabilitation and maintenance of feeder roads, which constitute the majority of the country's road network.

Uganda has a total network of over 23 000km of rural feeder roads (RFRs). Over the past years, efforts have been geared towards rehabilitation of the dilapidated roads using donor and Government funds. About 9000km have been rehabilitated since 1986, of which 4000km have been carried out using labour-intensive methods. I would therefore like to take this opportunity to express my appreciation on behalf of government to all those donors who have previously supported and those which are still supporting the feeder roads rehabilitation programmes in the county.

In the past, Government provided road construction equipment to the districts to enable them to effectively execute roadworks. However, the current fleet of road equipment is numerically insufficient to constitute at least one operational road unit per district and some of the equipment requires replacement due to old age.

This old equipment is now characterised by frequent breakdowns, making it uneconomical to operate because of the high maintenance and repair costs.

My Ministry therefore has realised the need for the districts to reduce reliance on heavy equipment for feeder road rehabilitation and maintenance. Since 1988, the Ministry has been carrying out labour-based feeder roads rehabilitation and maintenance works as a means to reduce the foreign capital drain implicit in the use of equipment-intensive methods, and as a means of creating employment.

All our routine maintenance of roads is entirely labour-based. Government is giving support to the districts in the form of a conditional grant for routine maintenance activities. For the past year, about US\$4.9 million was given to the districts in support of routine maintenance activities, which created employment for about 150 000 person-months.



My Ministry has also established a training centre at Mount Elgon Technical College, Mbale, which is being used for training of contractors and district staff in the planning, administering, supervision, and implementation of feeder-road rehabilitation and maintenance.

Over the past two years, this Training Centre has trained 14 small-scale rehabilitation contractors, 16 routine maintenance contractors, 53 contractors' foremen, 65 contractors' assistant foremen, and 17 district technical staff.

The training has also been focused on creating awareness of labour-based methods through seminars and workshops for local councillors in the districts. The trained contractors have rehabilitated 91km, and 350km are under routine maintenance using labour-based methods in the four eastern districts of Uganda.

Government has also obtained funds from DANIDA through the ILO for the establishment of the Labour-based Policy Promotion Committee (LAPPCOM) project which is being implemented through the Ministry of Planning and Economic Development. The purpose of the project is to contribute to the Government's efforts in poverty alleviation through formulation and coordination of labour-based policies, and capacity building for increased employment in the infrastructure sector.

The main objectives of the project are:

- To ensure that labour-based approaches are integrated and co-ordinated in the national planning process
- To ensure that technical and administrative capacity to implement labour-based works has been created in the public and private sector through training and development of manuals and guidelines
- To promote awareness among decision-makers and the general public about the importance of labour-based technology in generating employment
- To further research and development in the use of local resources as far as labour-based techniques are concerned.

Mr Chairman, it is my sincere hope that this seminar will yield results geared towards the promotion and betterment of labour-based technology so that, as the technology creates more employment opportunities, the infrastructure works are implemented without depending heavily on equipment-intensive methods.

I wish all the participants fruitful deliberations during the seminar, a happy stay in the country, and a safe journey back home at the end of the seminar. It is therefore my honour and pleasure to declare this Sixth Regional Seminar for Labour-based Practitioners open. Thank you.



### 8.3 ANNEX 3: CLOSING SPEECH

Hon. Wanjuzi-Wasieba, Minister of State for Works Transport and Communications, Uganda

Mr Chairman, distinguished participants, resource persons, ladies and gentlemen.

It is my pleasure and honour to officiate at the closing ceremony of this important and vital seminar. I understand that these regional seminars are held annually in different Sub-Saharan countries chosen by your participants. I would like to believe that the choice to have the seminar in Uganda is the result of the confidence that you have in respect of the country's positive exposure to labour-based technology. I must assure you that my Ministry, together with that of Local Government, are greatly honoured to have successfully hosted the Sixth Regional Seminar. I believe you have enjoyed your stay in Jinja, and have taken the opportunity to see the source of the River Nile and other geographical features like the Bujagali Falls.

I am informed that several countries and organisations have participated in the five-day proceedings. The wide experiences and expertise from the various participants must have proved useful to all of you, especially those attending this type of seminar for the first time.

The Uganda Government has placed roads as a top priority area due to the crucial role they play in national unity, security and economic development. It is therefore gratifying for Uganda to have hosted this regional seminar. I believe the seminar has provided an environment whereby participants have not only discussed labour-based technology but also shared experiences in other issues related to road construction and maintenance. You have travelled on some of our roads since you entered Uganda and we welcome not only compliments but also constructive criticisms.

Uganda started on road management reforms in 1989 when we participated in the Road Maintenance Initiative Conference in Addis Ababa. Since then Uganda has organised and participated in many seminars and conferences focused on changes for the betterment of the road network. In one of the seminars organised by the MoWTC and the ILO held in Kampala in 1992, the need to carry out some activities using labour-based technology was identified. Subsequent seminars and courses were conducted with the assistance of the ILO whereby procedures to use labour-based technology were worked out. I am happy to say that since we launched labour-based maintenance in my Ministry in January 1993, there has been a marked improvement in the routine maintenance upkeep of our roads. We do recognise that this programme requires improvement and support especially in areas of training and supervision. The MoWTC and the MoLG share problems in this regard. I hope this seminar has had time to recommend some solutions to these problems, among others.



I have been told that the seminar was spiced with an exhibition on tools and equipment not to mention some social functions. I think this was a very good idea since the exhibition and site demonstrations can vividly demonstrate the theory, which would prove difficult to image. The trip to Mbale must have proved a refreshing and useful undertaking.

Uganda encourages the use of labour-based technology where this is cheap and effective. Uganda will definitely continue to promote the use of labour in its programmes on both classified and feeder roads for some time to come and cherish the efforts of the donor community who encourage programmes such as this one to be conducted in Uganda.

Uganda has a strong policy with regard to regional corporation and hence fora of this nature help government to consolidate cooperation with other nations in the region. The Government will continue its participation in all fora that provide for transfer of technology and in which our people share experiences with those facing similar problems. I would like to believe that through this kind of cooperation, this region should be able to build local capacity and be able to exploit its resources meaningfully.

The challenge before participants of a seminar such as this one is how to sell the labour-based technology concept to various governments in the region as a viable option, especially in poor countries like Uganda. The bigger challenge is perhaps to introduce the technology as a subject in our technical institutions of learning. On this note, I am reliably informed that a one-day meeting for academicians will follow tomorrow in Kampala to address this issue among others. I must commend the organisers, as this is a most welcome initiative which government will encourage as much as possible. I will therefore be most interested to hear of the outcome of this one-day meeting.

Once again, I thank the organisers of this seminar, together with all resource persons, for having made the seminar a success. I urge all participants to put into practical use all of the knowledge and experiences you have acquired during the five-day seminar.

Let me take this opportunity to wish all of you a safe journey back home and hope that you will come again to our country.

It is now my pleasure to declare the Sixth Regional Seminar officially closed. I thank you all.



## 8.4 ANNEX 4: LIST OF SESSION CHAIRPERSONS AND PANELS OF EXPERTS

### Day One

#### Session One

**Chair:** Engineer H Robert Kibuuka, Ministry of Works Transport and Communications, Uganda

#### Session Two

**Chair:** Engineer Karuma-Kagyina, Ministry of Local Government, Uganda

#### Session Three

**Chair:** Engineer Joseph Mutabazi, Ministry of Works Transport and Communications, Uganda

**Panel:**

Engineer Barnabas Ariga, Kenya Institute of Highways and Building Technology, Kenya

Engineer Ben Ssebugga, Ministry of Works Transport and Communication, Uganda

Mr Walter Illi, Norconsult, Kenya

Mr Rob Petts, MART, UK

#### Session Four

**Chair:** Engineer Joseph Mutabazi, Ministry of Works Transport and Communications, Uganda

**Panel:**

Mr Herbert Trimborn, Trimborn Agricultural Engineering, Kenya

Mr Were Higienyi, Ministry of Local Government, Uganda

Mr Asfaw Kidanu, SweRoad, Zimbabwe

Mr Rob Geddes, Scott Wilson Kirkpatrick, Zimbabwe

### Day Two

#### Session One

**Chair:** Engineer Were Higienyi, Ministry of Local Government, Uganda



**Panel:**

Mr Osei-Bonsu, ILO/EAMAT, Ethiopia

Mr Henry Ashong, Department of Feeder Roads, Accra, Ghana

Mr Charles Walimbwa, Labour-based Contractors Association,  
Uganda

**Session Two**

**Chair:** Mr David Mason, ILO/ASIST, Kenya

**Panel:**

Mr David Jennings, Kisii Training Centre, Kenya

Dr Peter Komba, Ministry of Works, Tanzania

**Session Three**

**Chair:** Engineer Peter Ssebanakitta, Ministry of Works Transport  
and Communications, Uganda

**Panel:**

Mr Charles Ware, Theron Burke and Isaac, South Africa

Mr Peter Greening, Transport Research Laboratory, Zimbabwe

Engineer Ben Ssebugga, Ministry of Works Transport and  
Communications, Uganda

## Day Three

**Field Trip Facilitator:** Engineer Were Higenyi, Ministry of Local  
Government, Uganda

## Day Four

**Session One**

**Chair:** Mr Collins Antwi, Department of Feeder Roads, Ghana

**Panel:**

Mr Andreas Beusch, Intech Associates, Switzerland

Mr Jan de Veen, ILO/POLDEV, Switzerland

**Session Two**

**Chair:** Mr Collins Antwi, Department of Feeder Roads, Ghana

**Panel:**

Mrs Jane Tournée, ILO/ASIST, Zimbabwe



Ms Wilma van Esch, ILO/ASIST, Kenya

### Session Three

**Chair:** Engineer Barnabas Ariga, Kenya Institute of Highways and Building Technology, Kenya

**Panel:**

Dr Yaw Tuffour, University of Science and Technology, Kumasi, Ghana

Mr Gamalilhe Sibanda, ILO/ASIST, Zimbabwe

### Session Four

**Chair:** Dr Peter Komba, Ministry of Works, Tanzania

**Panel:**

Mr Carl-Eric Hedstrom, Roads Training School, Zambia

Prof. T Rwebangira, University of Dar es Salaam, Tanzania

## Day Five

### Session One

**Chair:** Mr G N Mackay, Arthur Garden, Zimbabwe

### Session Two

**Chair:** Engineer Karuma-Kagyina, Ministry of Local Government, Uganda



## 8.5 ANNEX 5: SEMINAR EVALUATION ANALYSIS

### 8.5.1 Questionnaire

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#### INSTRUCTIONS

Put a number in the boxes below to indicate **quality**.

Use a scale of 1 to 5 (1 = poor, 2 = fair, 3 = good, 4 = good, 5 = excellent).

For multiple choice questions, ring round your choice.

---

#### 1 Hotel Accommodation

Room facilities

Laundry facilities

Leisure facilities

Breakfasts

Value for money

Comments and suggested improvements: .....

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#### 2 Seminar Venue

Facilities

Refreshments

Lunches

Visual aids

Comments and suggested improvements: .....

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#### 3 Seminar Presentations

Chairpersons

Paper presenters

The papers themselves

Panels of experts

Plenary discussions

Use of pinboard, charts, and overhead projector

Were the themes appropriate? Yes/No

Was the *number* of papers too few/just right/too many?

Was the *length* of papers too short/just right/too long?

Comments and suggested improvements: .....





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#### **4 Seminar Organisation**

Choice of venue                      Secretariat support to participants

Registration                      Publications display                      Pinboard display (ASIST charts)

Was the conference too short/just right/too long?

Was the number of people too few/just right/too many?

Would you prefer group work sessions during the regional seminars? Yes/No

If yes, how much?

Comments and suggested improvements: .....

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#### **5 Field Visit**

Visit to roadworks                      Visit to Training Centre                      Lunch

Demonstrations (Hyson Cells, culvert moulds, handtools testing)

Exhibition of equipment

Comments and suggested improvements: .....

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#### **6 Seminar Transport**

To and from the airport                      To and from Jinja

To and from site visit                      Within the city

Comments and suggested improvements: .....

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#### **7 The Future**

What venue would you suggest for the next seminar?

What themes would you suggest for the next seminar?

How many main themes should a seminar address?

Should the seminar secretariat organise outside activities?

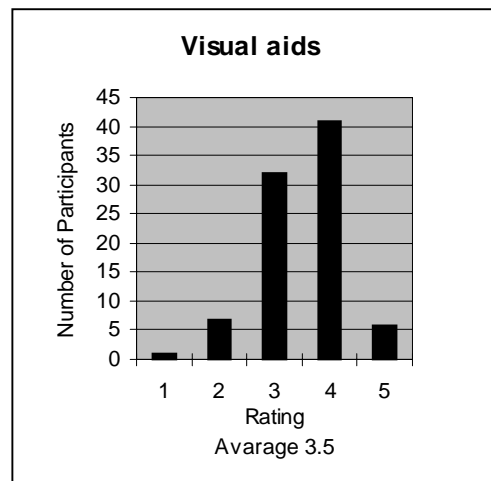
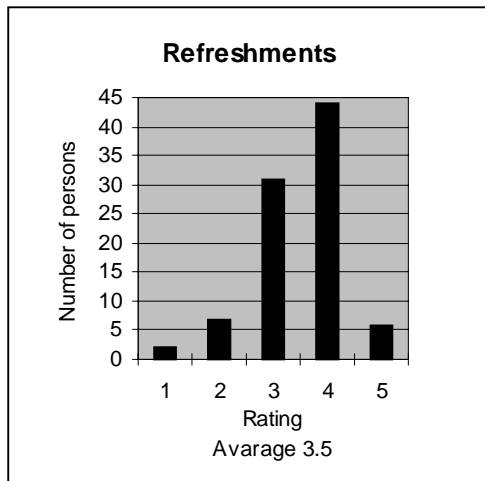
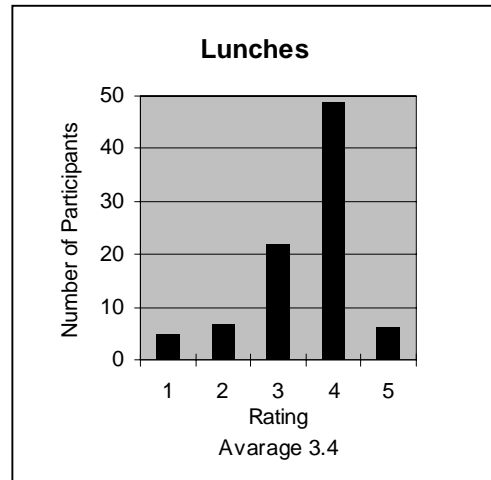
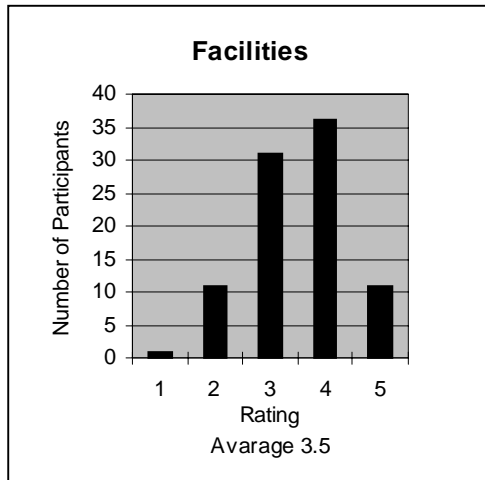
If yes, what do you suggest?

Any other comments or suggestions (present or future) can be made overleaf.





## 2 Seminar Venue

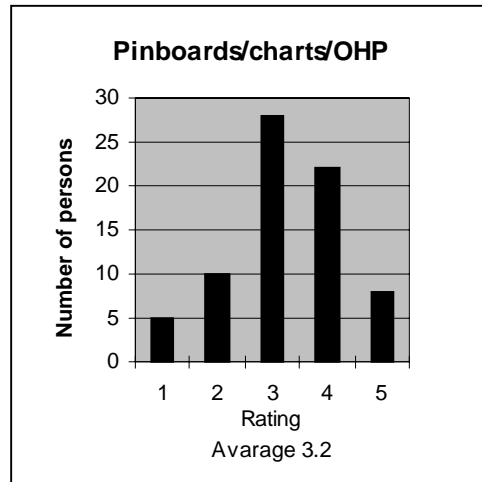
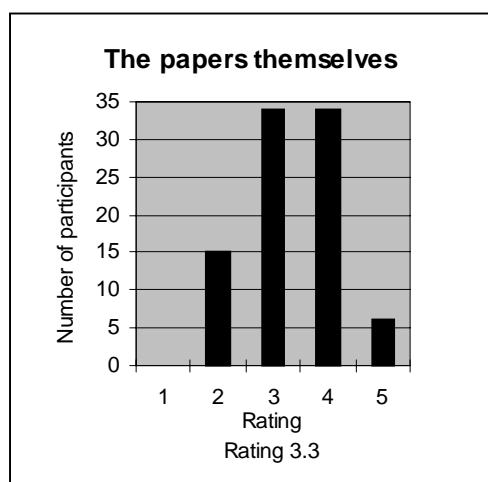
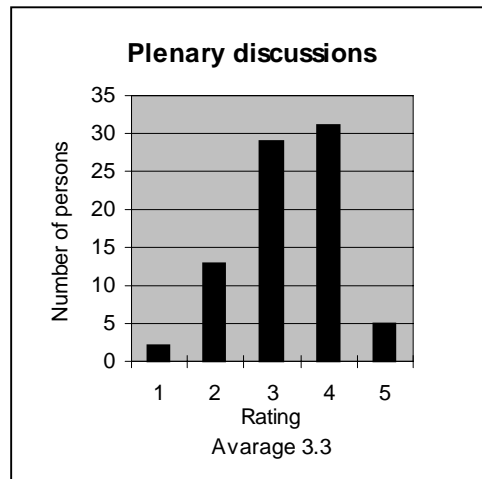
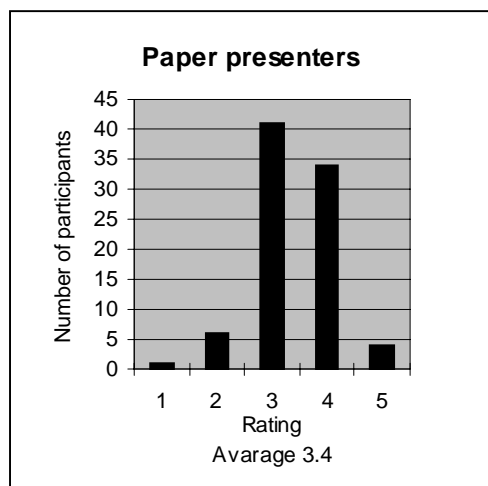
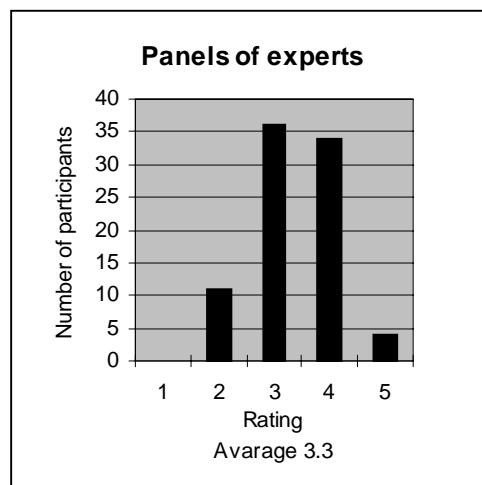
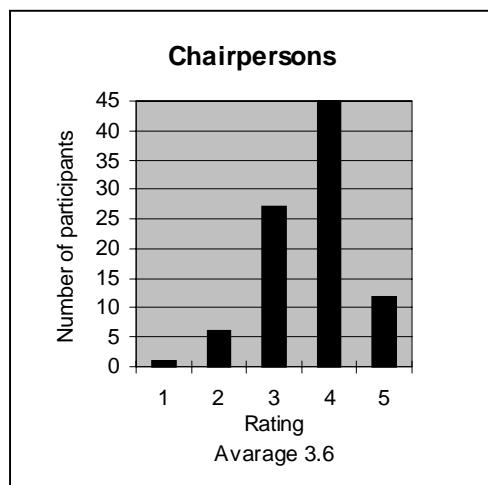


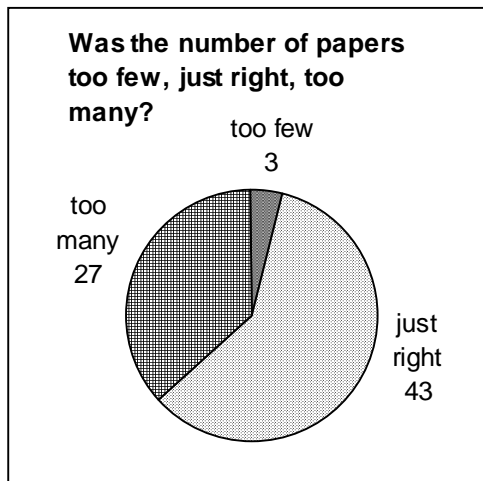
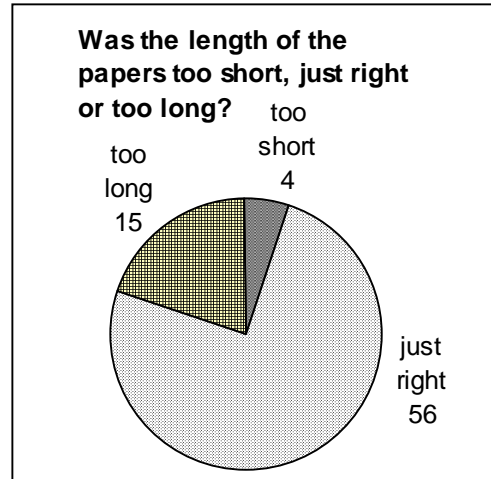
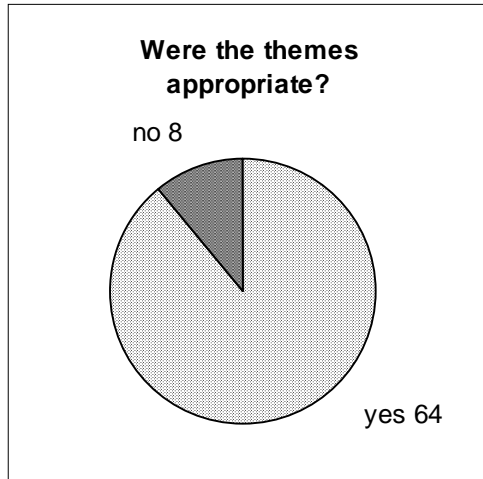
### *General comment on the seminar venue*

All participants should be booked into one hotel where the seminar takes place.



### 3 Seminar Presentations

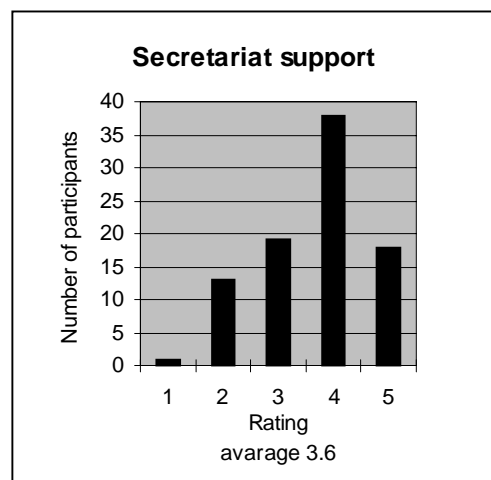
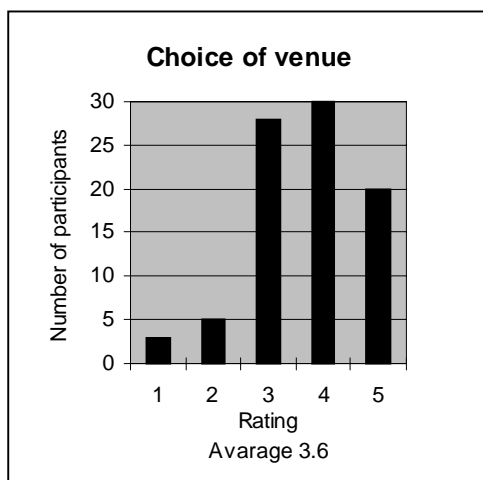


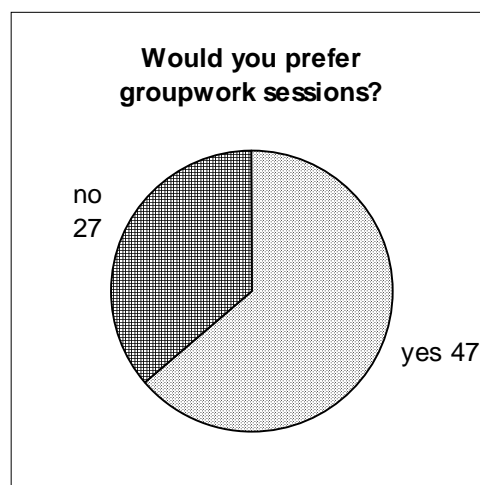
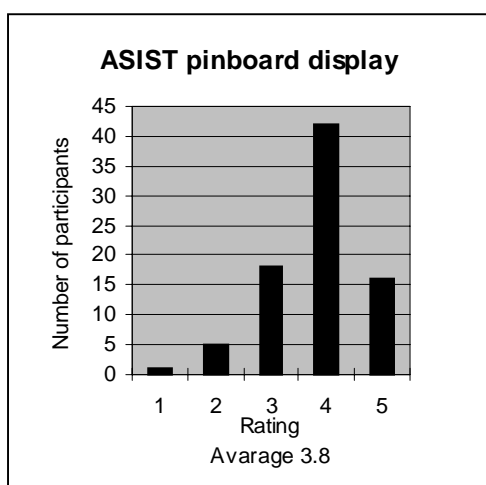
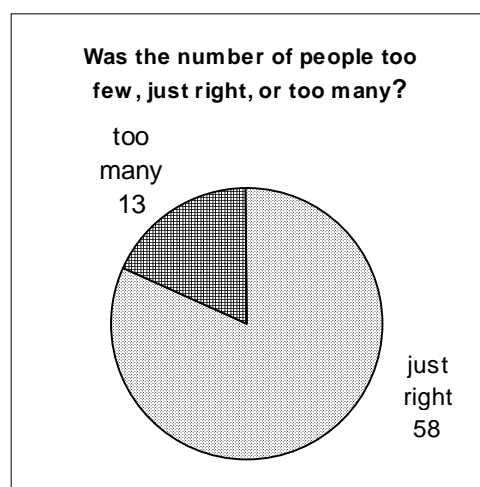
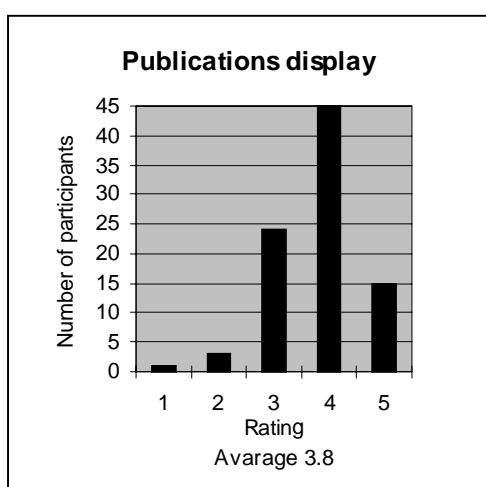
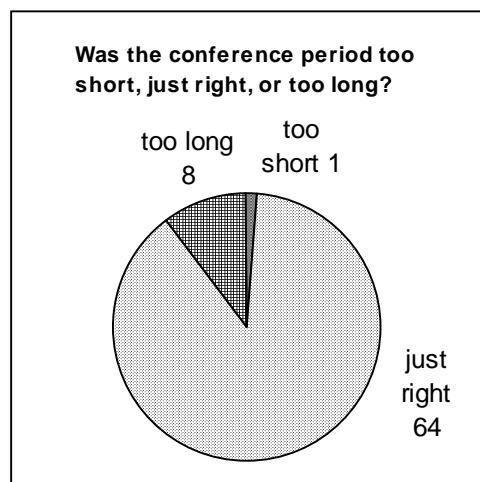
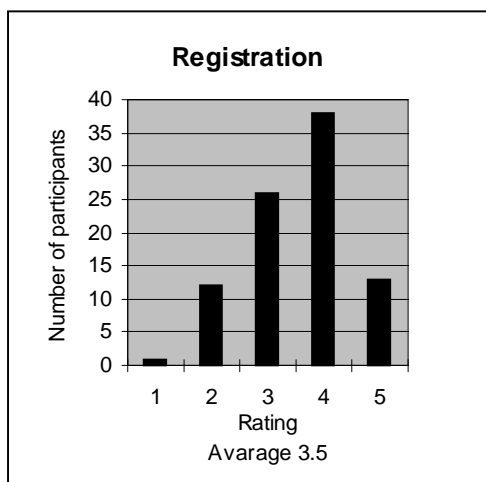


#### *General comments on the presentations*

Some papers did not address the theme. Papers should be distributed early before the presentations. More time for discussion required. Chairpersons did not control time effectively.

## 4 Seminar Organisation



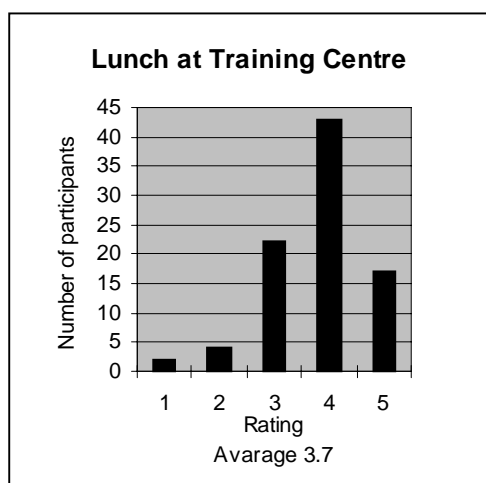
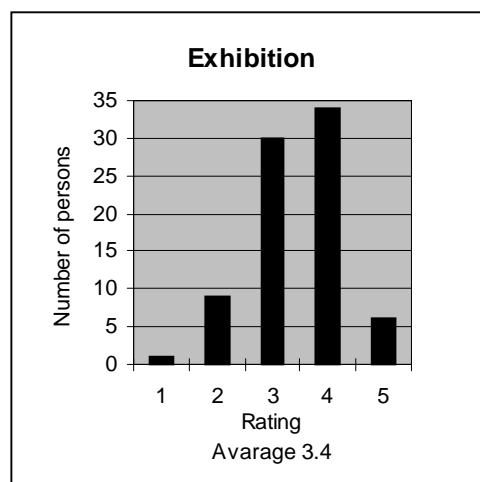
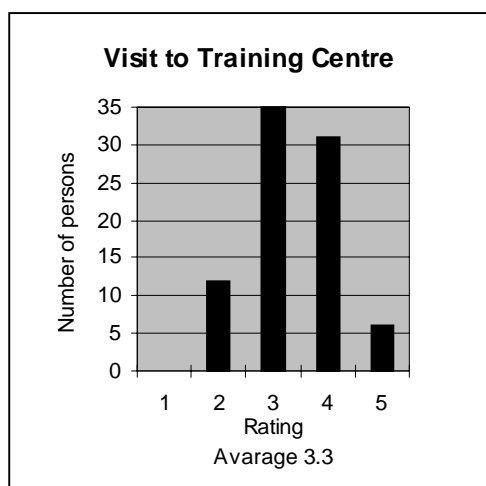
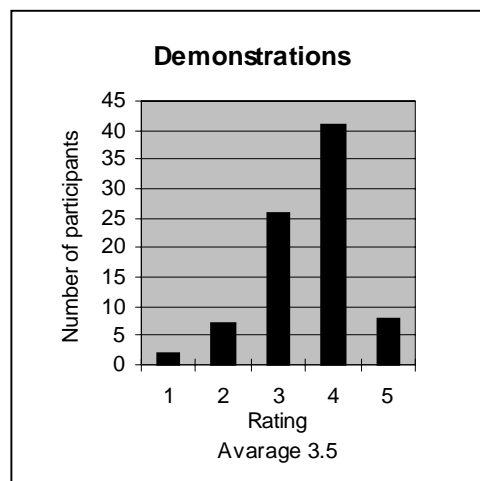
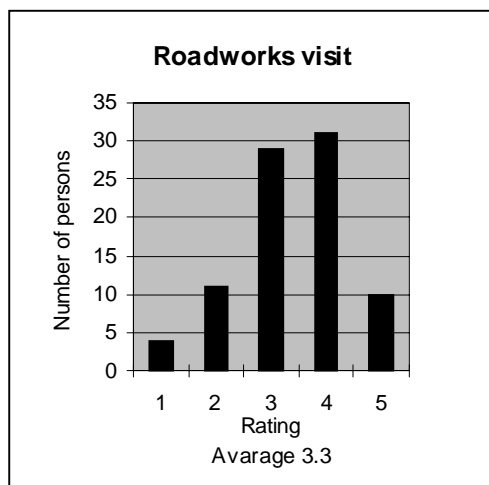


### *General comments on seminar organisation*

An external agency should be contracted to manage the seminar. The list of participants and the programme should be distributed before the seminar. Clearer information is required, with a daily timetable, on a notice-board. Improve the management of the seminar.



## 5 Field Visit

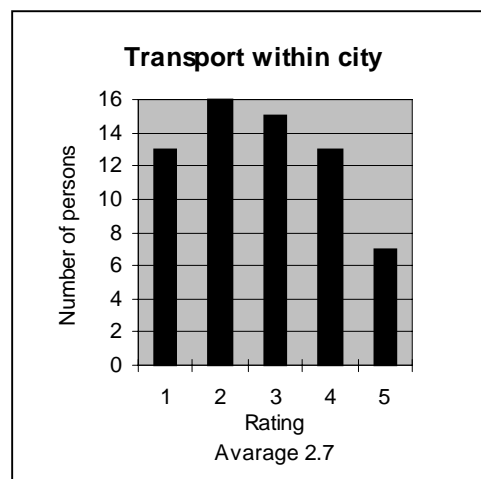
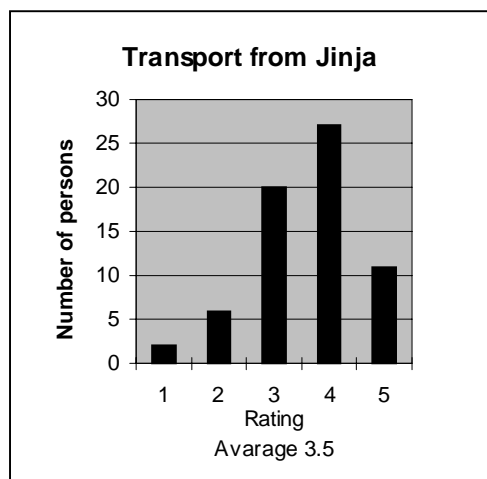
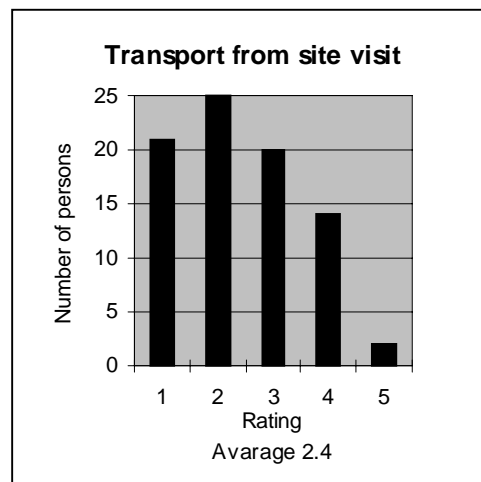
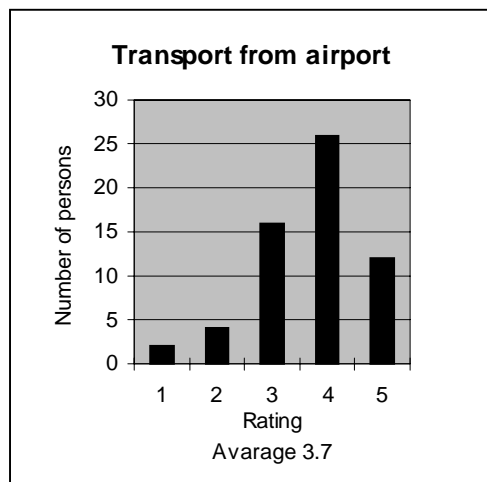


### *General comments on the field visit*

Motor graders should not have been included in the demonstration. A greater variety of exhibits was required. There was insufficient time for viewing equipment and fieldwork. Participants should be divided into smaller groups during site tours. Demonstrations should be near the conference venue.



## 6 Seminar Transport



### *General comments on transport*

Seminar organisers should ensure that only safe transport is hired for participants. Coordination of transport services should be improved. Transport should have been organised for participants at hotels in the evenings. Transport management was awful and poorly organised.





## 7 The Future

Participants proposed the following (number of participants in parentheses):

Countries	Zambia	(20)
	Egypt	(12)
	Zimbabwe	(7)
	Mozambique	(7)
	Other	(23)
Themes:	Contractor development	(20)
	Quality control, standards, equipment	(8)
	LBT outside the road sector	(7)
	Policies (incl. planning, finance and sustainability)	(7)
	Site management and labour productivity	(5)
	Impact of LBT (include environment)	(5)
	Training	(1)
Dates:	Early 1999	



## **8.6 ANNEX 6: LIST OF PARTICIPANTS**

in alphabetical order of surname.

The data contained in these tables has been extracted from the Registration Forms which the participants completed for the Secretariat.

No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
1	Abban, Richard	Mr	Department of Feeder Roads	Private Mail Bag, Ministries PO, Accra	Ghana	+233-21-668314 +233-21-663047	
3	Agaba, Janet	Ms	Nifra Construction	Box 5588, Kampala	Uganda	+256-41-256113 +256-41-235006	
4	Akidi, Pauline	Ms	Ministry of Finance and Economic Planning	Box 7086, Kampala	Uganda	+256-41-232317	
5	Akram, Ahmed	Mr	Ministry of Local Government	Box 7037, Kampala	Uganda	+256-41-232317 +256-41-341135	
6	Ampadu, Samuel Kofi	Dr	University of Science & Technology	Department of Civil Engineering, PMB, Ministries PO, Kumasi	Ghana	+233-51-60226 +233-51-60226	ampadu@ighmail.com
7	Andersson, Karin	Ms	National Directorate of Roads & Bridges (DNEP)	C/o SweRoad, CP 651, Maputo	Mozambique	+258-1-475045 +258-1-475221	karin@informat.uem.mz
8	Antwi, Collins	Mr	Department of Feeder Roads	PMB, Ministries PO, Accra	Ghana	+233-21-662125 +233-21-663047	
9	Aoloi, Pius	Mr	Ministry of Works Transport & Communications	Box 17, Kyambogo	Uganda	+256-41-285134	
10	Ariga, Barnabas	Eng.	KIHABT, Ministry of Public Works and Housing	Box 57511, Nairobi	Kenya	+254-02-534890 +254-02-534890	
11	Asare, Osei Augustin	Mr	Norconsult, Ministry of Local Government	Box 2237, Mbale	Uganda	+256-45-34515/6 +256-41-254576	
12	Asedri, Charles	Mr	Ministry of Works (ODA)	Box 19, Fort-Portal	Uganda	+256-483-22253	
13	Ashong, Emmanuel	Mr	Department of Feeder Roads	PMB, Ministries PO, Accra	Ghana	+233-21-668314 +233-21-663047	
14	Bergh, Adrian	Mr	CSIR/Transportek	11 Glynst, Pretoria 0083	South Africa	+27-12-8413491 +2712-841359	
15	Beusch, Andreas	Mr	Intech Beusch & Co.	Loestrasse 77, 7000 Chur	Switzerland	+41-81-3537975 +41-81-3537976	abeusch@spin.ch

<b>No</b>	<b>Surname, Forename(s)</b>	<b>Title</b>	<b>Organisation</b>	<b>Address</b>	<b>Country</b>	<b>Tel Fax</b>	<b>Email Address</b>
16	Blokhuis, Frans	Mr	ILO Contractor Training Project	Box 510032, Chipata	Zambia	+260-62-21107 +260-62-21107	blokhuis@zamnet.zm
17	Brudfors, Ulf	Mr	SweRoad	Box CY263, Causeway	Zimbabwe	+263-4-723585 +263-4-700706	ulfbrude@harare.iafrica.com
18	Chite, Annabel	Ms	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572555 +254-2-566234	iloasist@arcc.or.ke
190	Chubele, Jacob	Mr	Government of Botswana	P/Bag 00338, Gaborone B09	Botswana	+267-354268 +267-308611	
20	Coleman, Tony	Mr	Independent Consultant	1 Waterpark Road, L42 9NZ	UK	+44-1151-608-2376	
21	de Veen, Jan	Mr	ILO	CH-1211 Geneva 22	Switzerland	+41-22-7996414 +41-22-7996489	deveen@ilo.org
22	Ehab, Abdel Aziz	Mr	Social Fund for Development	Abdel Moniem Riad Square, Misr Insurance Building, Cairo	Egypt	+20-2-96327961 +20-2-96327962	
23	El-Feki, Abdallah	Mr	Social Fund for Development	Adnanan El Malky Street, Medical Insurance Building, Soltan Land	Egypt	+20-2-86340167 +20-2-86340169	
24	Fransen, Jan	Mr	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572555 +254-2-566234	iloasist@arcc.or.ke
25	Gebremedhn, Yohannes	Mr	MoLG (ECDF)	Box 225, Asmara	Eritrea	+291-1-22316 /21176 +291-1-120609	
26	Geddes, Robert	Mr	Scott Wilson Kirkpatrick	Box 3143, SWK House, 80 Mutare Road, Msasa, Harare	Zimbabwe	+263-4-787107 +263-4-787101	rgeddes@maf.org
27	Greening, Tony,	Mr	Transport Research Laboratory	Box CY 38, Harare	Zimbabwe	+263-4-726723 +263-4-726631	tony@trl.uz.zw
28	Hansen, Ragnar	Mr	Zambezia Infrastructure (IBIS)	CP 42, Quelimane	Mozambique	+258-4-213266 +258-4-213995	rhansen@maf.org
29	Hedstrom, Carl-Eric	Mr	Roads Training School	Box 32181, Lusaka	Zambia	+260-1-247185 +260-1-247264	

No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
30	Hendricks, Phil	Mr	CSIR, Roads and Transport Technology Unit	Box 395, Pretoria 1	South Africa	+27-12-8412717 +27-12-8413232	phendric@csir.co.za
31	Hjortnaes, Truls	Mr	Roughton International	Box 179, Lira	Uganda	Lira 90 +256-41-220623	
32	Hmensa, Martin	Mr	Department of Feeder Roads	Ministries Post Office, Accra	Ghana	+233-27-544185	
33	Hongve, Jon	Mr	Ministry of Local Government	Box 2237, Mbale	Uganda	+256-45-33109 +256-41-254576	
34	Illi, Bruno	Mr	Norconsult	Box 48176, Nairobi	Kenya	+254-2-337771 +254-2-337703	norcon@form-net.com
35	Illi, Walter	Mr	Norconsult	Box 48176, Nairobi	Kenya	+254-2-225580 +254-2-337703	norcon@form-net.com
36	Iwumbwe, Hudson	Mr	Ministry of Works, Mubende (ODA)	Box 91, Mubende	Uganda	+256-464-4135	
37	Jennings, David	Mr	Kisii Training Centre	Box 30752, Nairobi	Kenya	+254-2-561848 +254-381-21634	ktc@form-net.com
38	Kabanga, Joseph	Mr	Kagga & Partners	Box 6583, Kampala	Uganda	+256-41-233537 +256-41-233538	
39	Kabiru-Kangethe, Angela	Mrs	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572555 +254-2-566234	iloasist@arcc.or.ke
40	Kaddu, T M	Mr	Akamba (U) Ltd	Box 20028, Kampala	Uganda	+256-41-222501/2 +256-41-222503	
41	Kahled, Fatehy	Mr	Social Fund for Development	1 Hussen Hegazi, Kalsr El Anni, Cairo	Egypt	+20-2-3540077 +20-2-3030891	
42	Kapundanga, Samuel	Mr	Ministry of Transport	Box 3146, Bulawayo	Zimbabwe	+263-9-71846/6 +263-9-63018	
43	Karanja, Frank David	Mr	Ministry of Public Works and Housing	Box 30260, Nairobi	Kenya	+254-2-723101 +254-2-720044	
44	Karuma-Kagyina	Eng	Ministry of Local Government	Box 7037, Kampala	Uganda	+256-41-285211 +256-41-222643	
45	Kidanu, Asfaw	Mr	SweRoad	Box CY263, Causeway, Harare	Zimbabwe	+263-4-722195 +263-4-700706	asfawkid@harare.iafrica.com

No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
46	Kigundu, B M	Dr	Makerere University	Box 7062, Kampala	Uganda		
47	Komba, Peter	Dr	Ministry of Works	Box 9423, Dar-es-Salaam	Tanzania	+255-51-118650	
48	Kunbi, Tesfaye	Mr	Care Ethiopia	Box 4710, Addis Ababa	Ethiopia	+251-1-613422 +251-1-61190	
49	Kyombo, Laurent	Mr	Ministry of Works	Box 9423, Dar-es-Salaam	Tanzania	+255-51-118650	
50	Larcher, Paul	Mr	MART	Institute of Development Engineering, Loughborough University, LE11 3TU	UK	+44-1509-222612 +44-1509-211079	p.a.larcher@lboro.ac.uk
51	Leokaoko, Mohlakala	Mr	Civil Works Section	P/Bag A 155, Maseru 100	Lesotho	+266-1-336505	
52	Little, Rob	Mr	University of Natal	P/Bag Dalbridge 4041	South Africa	+27-31-2601059 +27-31-2601411	little@engund.ac.za
53	Lynbeech, Jan Bloch	Mr	Zambezia Infrastructure (IBIS)	CP 42, Quelimane	Mozambique	+258-4-421347 +258-4-213264	
54	Mackay, G N	Mr	Arthur Garden Engineering	Box 2342, Harare	Zimbabwe	+263-4-754274	
55	Makakole, Kori	Mr	Labour Construction Unit	Box 100, Maseru	Lesotho	+266-320283	
56	Manyindo, Chris	Mr	Ministry of Works Transport & Communications	Box 10, Entebbe	Uganda	+256-42-20101 +256-42-20135	mowtc@imul.com
57	Mason, David	Mr	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572580 +254-2-566234	iloasist@arcc.co.ke
58	Matovu, Isaac	Mr	Ministry of Works Transport & Communications	Box 50, Hoima	Uganda	+256-465-40218	
59	Mlaponi, Frederick	Mr	Ministry of Works	Box 9423, Dar es Salaam	Tanzania	+255-51-118650	

No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
60	Molapo, Paul	Mr	Hyson Cells Ltd	Box 319, Muldersdrift, 1747 Johannesburg	South Africa	+27-11-9572478 +27-11-9572547	
61	Mpandey, B	Dr	Uganda Polytechnic Kyambogo	Box 7181, Kampala	Uganda	+256-41-285211 +256-41-222643	
62	Mugisha, Valentine	Mr	Ministry of Works (ODA)	Box 36 , Masindi	Uganda	+256-465-20013	
63	Mulonga, Daniel	Mr	Roads Training School	Box 30918, Lusaka	Zambia	+260-1-247185 +260-1-247264	
64	Muonima, Jorge Tomas	Mr	National Directorate of Roads & Bridges (DNEP)	1225 Mozambique Avenue, Maputo	Mozambique	+258-01-475045 +258-1-475225	
65	Mushota, Charles	Mr	Roads Training School	Box 30918, Lusaka	Zambia	+260-247185 +260-247264	
66	Musumba, William	Eng	Ministry of Works Transport & Communications	Box 10, Entebbe	Uganda	+256-42-20125 +256-42-20135	twins@imul.com
67	Muswero, Peter	Mr	Department of Transport	P/Bag X9043, PMB Pietermaritzburg	South Africa	+27-331-355702 +27-331-3558090	
68	Mutabazi, Joseph	Eng	Ministry of Works Transport & Communications	Box 17, Kyambogo	Uganda	+256-41-222643	
69	Mwangi, G Muchira	Mr	Ministry of Public Works and Housing	Box 19597, Nairobi	Kenya	+254-2-726998 +254-2-720044	
70	Mwatelah, Z K	Dr	Jomo Kenyatta University of Agriculture and Technology	Box 62000, Nairobi	Kenya	+254-151-22646 +254-151-21764	
71	Nangosyah, Willy	Mr	Ministry of Works Transport & Communications	Box 931, Mbale	Uganda	+256-45-344900	
72	Ndiritu, Joseph	Mr	Ministry of Public Works and Housing	Box 460, Kerugoya	Kenya	+254-156-21126 +254-156-21126	
73	Ndui, Kennedy	Mr	ILO Contractor Training Project	Box 510032 ,Chipata	Zambia	+260-62-21107 +260-62-21107	eproads@zamnet.zm

<b>No</b>	<b>Surname, Forename(s)</b>	<b>Title</b>	<b>Organisation</b>	<b>Address</b>	<b>Country</b>	<b>Tel Fax</b>	<b>Email Address</b>
74	Norohha, Manoel Azevedo	Mr	World Vision International	Box 123, Quelimane	Mozambique	+258-4-212746	
75	Odongo, M	Mr	Ministry of Works Transport & Communications	Box 10, Entebbe	Uganda	+256-42-20101 +256-42-20135	mowtc@imul.com
76	Ogero, Nyataro	Mr	Kisii Training Centre	Box 2254, Kisii	Kenya	+254-381-21634 +254-381-21634	ktc@form-net.com
77	Ojuka, Tom	Eng	Ministry of Local Government	Box 7037, Kampala	Uganda	+256-41-341767 +256-41-257692	
78	O'Leary, Tony	Mr	Roughton International	Box 5481, Kampala	Uganda	+256-41-341135 +256-41-257692	roughton@imul.com
79	Orwa, Sam	Mr	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572522 +254-2-566234	iloasist@arcc.or..ke
80	Osei-Bonsu, Kwaku	Mr	ILO/EAMAT	Box 2532, Addis Ababa	Ethiopia	+251-1-517320 +251-1-513633	iloaddis@telecom.net.et
81	Otemo, John	Mr	Ministry of Local Government	Box 2237, Mbale	Uganda	+256-41-34156	
82	Otim, Joseph	Mr	Ministry of Works Transport & Communications	Box 130, Jinja	Uganda	+256-43-20572	
83	Pemberton, Crispin	Mr	New Dawn Engineering	Box 3223, Manzini	Swaziland	+268-85016 +268-85016	new_dawn@compuserve.com
84	Petts, Rob	Mr	MART/Intech Associates	53 The Park, Great Bookham, Surrey, KT23 3LN	UK	+44-1372-454072 +44-1372-458955	rob@intech-consult.demon.co.uk
85	Prieto, Maria	Ms	ILO	CH-1211 Geneva 22	Switzerland	+41-22-799-7263 +41-22-799-6489	prieto@ilo.org
86	Rwebangira, Theophil	Prof	University of Dar es Salaam	Box 35131, Dar es Salaam	Tanzania	+255-51-43500 +255-51-43029	rweba@mce.udsm.ac.tx
87	Sakwiya, Silamba Alfred	Mr	Ministry of Local Government, Feeder Roads Project	Box 510032 Chipata	Zambia	+260-6221177 +260-6221107	eproads@zamnet.zm
88	Salato, Arnindo	Mr	IBIS, Zambezia Infrastructure	CP 42, Quelimane	Mozambique	+258-4-213266 +258-4-213264	rhansen@maf.org



No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
89	Salewi, Kumbwaeli	Mr	National Income Generation Programme	Box 1721, Dar es Salaam	Tanzania	+255-51-34446 +255-51-29520	
90	Sibanda, Gamelihle	Mr	ILO/ASIST	Box 210, Harare	Zimbabwe	+263-4-748344 +263-4-759427	gama@ilo.org
91	Sibaya, Ida Tsitsi	Ms	ILO/ASIST	Box 210, Harare	Zimbabwe	+263-4-748345 +263-4-759427	chimedza@ilo.org
92	Smut, John	Mr	Department of Public Works	Private Bag X 65, Pretoria 0001	South Africa	+27-12-3372092 +27-12-3234649	
93	Ssebugga- Kimeze	Mr	Ministry of Works Transport & Communications	Box 10, Entebbe	Uganda	+256-42-20125 +256-42-20135	mowtc@imul.com
94	Ssekatawa, John	Mr	Ministry of Planning & Economic Development	Box 7184, Kampala	Uganda	+256-41-233583 +256-41-254244	mdp@starcom.co.ug
95	Stenstrom, Tomas	Mr	ILO/ASIST	Box 210, Harare	Zimbabwe	+263-4-748347 +263-4-759427	stenstrom@ilo.org
96	Stoffberg, Stephanus	Mr	Power Group of Companies	Box 129, Black 7580	South Africa	+27-21-9051755 +27-21-9052284	
97	Symington, Ron	Mr	O'Sullivan & Graham CID	Box 23660, Kampala	Uganda	+256-41-220290 +256-41-220290	ron.symington@acc.co.uk
98	Taylor, Gary	Mr	IT Transport	The Old Power Station, Ardington, Near Wantage OX12 8QJ	UK	+44-1235-833753 +44-1235-832186	ittran@rmplc.co.uk
99	Tembo, Simon	Mr	ILO Contractor Training Project	Box 510032, Chipata	Zambia	+260-62-21107 +260-62-21107	eproad@zamnet.zm
100	Tessem, Terje	Mr	ILO/SAMAT	Box 210, Harare	Zimbabwe	+263-4-748344 +263-4-759427	tessem@ilo.org
101	Tindyebwa, F W	Mr	Ministry of Works Transport & Communications	Box 10, Entebbe	Uganda	+256-42-20117 +256-42-20135	mowtc@imul.com
102	Tini, Tennyson	Mr	Power Group of Companies	Box 129, Blackheath	South Africa	+27-21-9051755 +27-21-9052284	

No	Surname, Forename(s)	Title	Organisation	Address	Country	Tel Fax	Email Address
103	Tournée, Jane	Ms	ILO/ASIST	Box 210, Harare	Zimbabwe	+263-4-74885 +263-4-759427	tournee@ilo.org
104	Trimborn, Herbert	Mr	Trimborn Agricultural Engineering	Box 756, Nakuru	Kenya	+254-37-211911 +254-37-41274	
105	Tuffour, Yaw	Dr	University of Science and Technology	Department of Civil Engineering, Kumasi	Ghana	+233-51-60226 +233-51-60226	
106	van Esch, Wilma	Ms	ILO/ASIST	Box 60598, Nairobi	Kenya	+254-2-572555 +254-2-566234	iloasist@arcc.or.ke
107	van Huyssteen, Stephen	Mr	CSIR/Transportek	Box 395, Pretoria 0001	South Africa	+27-12-8414006 +27-12-8413585	shuysste@csir.co.za
108	Walimbwa, Charles	Mr	Labour Contractors Association	Box 1626, Mbale	Uganda	+256-45-33053	
109	Ware, Charles	Mr	Theron Burke & Isaac	Box 748, Westville 3630	South Africa	+27-31-2668363 +27-31-2668367	ebi@saol.com
110	Warren, Philip	Mr	ODA	Box 23660, Kampala	Uganda	+256-41-220290 +256-41-220290	
111	Waruru, Robert	Mr	Kisii Training Centre	Box 2254, Kisii	Kenya	+254-381-21634 +254-381-21634	ktc@form-net.com
112	Watermeyer, Ron	Mr	Soderlund & Shutte	Beren 2198, Johannesburg	South Africa	+27-11-4024072 +27-11-4041726	ssinc@global.co.za
113	Were-Higenyi, Fred	Mr	Ministry of Local Government	Box 7037, Kampala	Uganda	+256-41-254489 +256-41-254244	mdp@starcom.co.ug
114	Wobusingye, Frederik	Mr	COWI Consulting Engineers	Box 10591, Kampala	Uganda	+256-41-343045 +256-41-343243	cowi@imul.com
115	Yanney, Benjamin	Mr	University of Zambia	Box MP 167, Harare	Zimbabwe	+263-4-303211 +263-4-303280	

