

INTERMEDIATE EQUIPMENT FOR LABOUR-BASED ROADWORKS

ACCRA, GHANA
19 & 20 APRIL 1996

Workshop Report

MART WORKING PAPER No 5

**Compiled by
Paul Larcher, Derek Miles and Robert Petts**

MART - ASIST - DFR, Ghana

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Intech Associates & IT Transport

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ACRONYMS

ASIST	Advisory Support, Information Services and Training
BPWA	British Public Works Association
CRRI	Central Road Research Institute (India)
CSIR	Centre for Scientific and Industrial Research (RSA)
CTP	Construction Technology Paper (ILO Geneva)
DBSA	Development Bank of Southern Africa
DCP	Dynamic Cone Penetrometer
DFR	Department of Feeder Roads (Ghana)
EQP	Equipment
EU	European Union
ILO	International Labour Organisation
ITEAN	A small truck powered by a 5-15 hp two stroke engine, capable of carrying up to 2 m ³ , manufactured in Thailand and used throughout S.E. Asia
ITT	S.E. Asia
KTC/KTS	I. T. Transport (Consultants)
LB	Kisii Training Centre/School
LCU	Labour-based
LGED	Labour Construction Unit (Lesotho)
LR	Local Government Engineering Department
MART	Laboratory Report (TRL)
MRP	Management of Appropriate Road Technology
ODA	Minor Roads Programme
PIARC	Overseas Development Administration (UK) Permanent International Association of Road Congresses (now known as “World Road Association”)
PTO	Power Take Off
R&D	Research and Development
RARP	Research and Development
RSA	Rural Access Roads Programme
SWKP	Republic of South Africa
TDR	Scott Wilson Kirkpatrick and Partners
TRL	Technology Development and Research (ODA)
UK	Transport Research Laboratory (UK)
UST	United Kingdom
WB	University of Science and Technology, Kumasi (Ghana)
2WD	World Bank
4WD	Two Wheel Drive Four Wheel Drive

1. PREFACE

Since the early 1970's the ILO and other organisations have promoted the development of efficient labour based roadworks, initially through the road administrations and more recently encouraging the development of domestic private contractors.

Although the road programmes are based on the use of labour, certain *intermediate* types of equipment are required to support the labour operations. These include, for example, items required for compaction and haulage, for which labour is not well suited.

INTERMEDIATE EQUIPMENT

Simple or intermediate equipment designed for low initial and operating costs, durability and ease of maintenance and repair in the conditions typical of a limited-resource environment, rather than for high theoretical efficiency. It is preferable if the equipment can also be manufactured or fabricated locally.

It has been realised that the development of intermediate equipment is lagging behind other aspects of the sector. Since the 5th Regional Labour-based roadworks seminar was to be held in Accra during April 1996 under the joint auspices of DFR and ASIST, the opportunity was taken to promote a 2-day workshop immediately preceding the seminar to discuss these issues. The Accra workshop jointly run by MART and ILO and supported by DFR provided a unique opportunity for experts to come together to review the current situation and further development needs for intermediate technology equipment. Participants included representatives of road authorities, agencies, contractors, consultants and manufacturers involved in the equipment aspects of the labour based roadworks sector.

It is intended that the results of the workshop set out in this working paper, together with follow up research, will enable recommendations to be made and disseminated to practitioners in road authorities, advisory organisations, contractors and suppliers. The aim is to improve knowledge, availability, acceptance, diversity and quality of intermediate equipment for use on roadworks.

Both the ILO and the MART initiative will welcome comments on this working paper, including information on successful (and unsuccessful) operational experience with intermediate equipment. Suggestions are also welcome for other topics which should be tackled in order to enable labour-based technologies to be fully competitive and sustainable.

2. ACKNOWLEDGEMENTS

The MART team are grateful to **Mr C. D. Antwi**, Director of Feeder Roads for his opening address and support of the workshop.

We wish to acknowledge the contribution made by all the participants listed below and particularly to **Mr R. Abban** and **Mr C. Williams** for their work in organising the workshop facilities. We are also grateful to **Sammy Akiwumi** for his work in producing the tables in this report.

The active cooperation of the ASIST personnel under the direction of **David Mason** enabled the effective planning, organisation and successful outcome of the workshop in conjunction with the MART team.

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This report has been compiled by **Paul Larcher**, **Derek Miles** and **Robert Petts** under the MART initiative funded by ODA under TDR programme arrangements.

3. WORKSHOP SUMMARY

The workshop approach and conclusions can be summarised as follows:-

APPROACH

- Identification of Issues related to Intermediate Equipment for Labour Based Roadworks
- Identification of Equipment Items to be covered by the MART guidelines
- Identification of available information/useable designs/specifications on each Equipment Item
- Identification of items on which more R&D work is required - prioritised
- Agreement on actions required to promote R&D, standards, and availability of intermediate equipment

The workshop follow-up should support the development of:-

- Guidelines on specification, procurement and management/support of intermediate equipment

A number of key issues were identified as influencing the availability, cost and performance of intermediate equipment. These can be grouped as:-

KEY ISSUES

- Institutional
- Operational
- Training

Due to the time constraints of the workshop, following identification of key topic areas, the participants focused on the operational issues relating to the priority groups of Intermediate Equipment.

Intermediate Equipment items suitable for use in labour based roadworks were identified and grouped in the following categories for assessment and development of MART guidelines:-

EQUIPMENT CATEGORIES (PRIORITISED)

- Haulage
- Compaction
- Structures
- Others

Further actions on R&D and dissemination were agreed for the priority equipment items.

4. WORKSHOP STRATEGY

The workshop programme is attached as Annex 1, and the opening address by Mr C D Antwi is attached in Annex 2. The objective of the workshop was to produce “Detailed recommendations and action plan regarding the production of a document setting out guidelines on **Intermediate Equipment for Labour-based Small Scale Contracting** in the road sector” (Reviewing & Consolidating experiences to date). The guidelines are to cover both rural and urban road sectors.

The initial expectations of the participants are set out in Annex 3. After explanation of the respective roles and roles of ILO/ASIST (see Annex 4) and MART, the workshop reviewed the following background documentation:-

- ILO - MART questionnaires on intermediate equipment - results and analysis of returned questionnaires received to date (draft MART Working Paper No 2).
- Papers submitted for BPWA/MART competition under the headings “Intermediate Equipment” (Messrs Hamper, Hancox, Hodge and Wedd) and “Handtools” (Murty)¹.

The workshop identified topics under the three headings of Institutional, Operational and Training issues as set out on the following page.

Although participants recognised the importance of both institutional and training issues, it was agreed that, in the limited time available, it would be most productive for the workshop to focus on the detailed identification of operational issues and priorities.

Both MART and the ILO recognise the need to stimulate conceptual work on the various topics that were identified under the *institutional* heading. This work will proceed in parallel with the work programme on operational issues set out in Sections 6 and 8. Conceptual work on institutional issues will aim *inter alia* to draw attention to the importance of practical research and development on intermediate equipment; this can rarely be achieved within the context of operational projects with out additional dedicated resources, however it is essential if those projects are to be effective.

Several participants drew attention to the need for teaching and training material based on comparative operational data on equipment performance.

¹ An edited version of these papers has been issued as MART Working Paper No 4.

INTERMEDIATE EQUIPMENT ISSUES

INSTITUTIONAL	OPERATIONAL	TRAINING
LOCAL MANUFACTURE	DESIGNS	EQP. MAINTENANCE TRAINING
QUALITY ASSURANCE CONTROL	SPECIFICATION	EQUIPMENT MANAGEMENT
JOB CREATION	PROCUREMENT	USE OF EQUIPMENT
FINANCE AVAILABILITY	PERFORMANCE ASSESSMENT	OPERATOR TRAINING
DONOR (TIED) FUNDING	PERFORMANCE DATA	
DONOR EQUIPMENT FUNDING POLICY	COSTING	
R & D	APPROPRIATE MIX OF EQUIPMENT	
USE OF LOCAL RESOURCES	RECOMMENDED MODELS	
PROCUREMENT	EQUIPMENT FOR MAINTENANCE	
TECHNOLOGY ENVIRONMENT	MAINTENANCE OF EQUIPMENT	
AVAILABILITY OF EQUIPMENT FOR HIRE	EQUIPMENT CHOICE (CULTURAL)	
GOVERNMENT FISCAL POLICY		
CREDIT / LEASE ARRANGEMENTS		

5. SUMMARY OF EQUIPMENT ITEMS

Following the identification of key issues, the workshop proceeded to discuss problems, practices and needs related to specific items of intermediate equipment.

This was initially carried out by compiling a list of 11 roadworks operations. In order to facilitate discussion these operations were ranked in order of importance. The top 5 operations were agreed to be:

1. Haulage
2. Compaction
3. Structures
4. Spreading
5. Supervision

For each of the 11 operations the workshop prepared a list of all intermediate equipment items that were known to the group. These lists are shown on the chart overleaf. The number of equipment items was considered too large for the participants to discuss every item within the two day workshop. This resulted in an additional ranking exercise which identified items of equipment that were not considered a high priority, and would therefore not be discussed during the workshop. These low priority items, that include a number of standard "off the shelf" items, are shown in shaded boxes on the chart.

INTERMEDIATE EQUIPMENT CATEGORIES

HAULAGE	COMPACTION	STRUCTURES	SPREADING	SUPERVISION	EXCAVATION	BITUMEN	ANCILLARY EQUIPMENT
TRACTOR 2WD	PEDESTRIAN VIBRATING ROLLER	CULVERT MOULDS STEEL	TOWED GRADER	BICYCLE	DISC PLOUGH	BITUMEN HEATER	CHAIN SAW
TRACTOR 4WD	TOWED DEADWEIGHT ROLLER	CULVERT MOULDS WOOD	TIPPING TRAILER	MOTORBIKE	SCARIFIER	BITUMEN HAND SPRAYER	WATER PUMP
TIPPER TRUCK	RIDE ON VIBRATING ROLLER	PREFABRICATED FORMWORK	TOWED DRAG	2WD PICKUP	TINE PLOUGH	BITUMEN TRUCK SPRAYER	JACK HAMMER
FLAT TRUCK	TOWED VIBRATING ROLLER	CONCRETE MIXER	GRADER PLATE	4WD PICKUP	SCOOP	CHIPPING DISTRIBUTION	COMPRESSOR
DUMPERS	TOWED BOWSER	CONCRETE VIBRATOR	TIPPER TRUCK	CARAVAN	SCRAPER	SLURRY BOX	CUTTING TOOL
POWER TILLER	HAND DRAWN ROLLER	SIMPLE CRANE			ROCK DRILL		FUEL BOWSER
ITEAN	LADEN TRUCK/ TRAFFIC	CONCRETE DUMPER					VULCANISING EQUIPMENT
TRAILER	WATER PUMP	CONCRETE PAVER PRESS					
HITCHING SYSTEMS	VIBRATING PLATE	WATER PUMPS					
STAND FOR TOWED ITEMS	GENERAL	HAND OPERATED MOBILE CRUSHER					
WHEELBARROW							
HAND CART							
ANIMAL CARTS							
				SURVEY & TESTING EQP.	SOIL STABILISATION	CRUSHING	
				TEMPLATE	HARROW	MOBILE CRUSHER	
				D.C.P	SPRAY EQUIPMENT		
				SCHMIDT HAMMER	ROTAVATOR		
				DUMPY LEVEL			
				DENSITY METER			

6. EQUIPMENT CATEGORIES

The items of equipment that were considered by participants to be of a high priority were discussed in four categories, representing what were seen as the three most important operations in labour-based roadworks:

- Haulage
- Compaction
- Structures

plus a group referred to as:

- Other Priority Items

For each of these four categories the workshop:

- Identified the information that is currently available.
- Highlighted areas for further research and development.
- Agreed the action required and the organisation(s) that should undertake the work.

These findings are summarised in the charts on the following four pages.

HAULAGE	INFORMATION AVAILABLE	MORE R & D	ACTION REQUIRED	
TRACTOR 2WD	Kenya Report on 3 tractors '87 Asist brief no 1 page 16 WB 1978 study Trailer Offloading study '94 Kenya Frans Blokhuis Tanga 1990 Photographic report	Write up exisiting projects experiences - force account & contractor	MART-ILO working paper on equipment selection, procurement, management & support Individual Technical briefs on equipment items - Asist-Mart plan of action Write up experiences of procurement & mechanical support Ghana	
TRACTOR 4WD	None	Determine situations (limited) where 4wd req'd for haulage		
TIPPER TRUCK	Kenya RARP (Walter Illi) KTS study 1985 WB 1978 study	Write up Lesotho & Tanzania experiences Could lead to more R & D		
FLAT TRUCK	Frans Blokhuis report Tanga 1990	Comparative performance Flat- bed \ Tipper \ Tractor-Trailer		
DUMPERS	No experience on L B projects in Africa	Not a priority		
POWER TILLER	Lars Karlsson CTP 44 , 62, 63 & 64 CRRRI I.T.Transport Studies in Cambodia, Laos, Indonesia	DFR propose trials 1997		
ITEAN	Draft Report by Shone & Edmonds - Cambodia	African Trials (Ghana?) Req'd		ILO-DFR/Kenya to investigate trial project possibilities
TRAILER	ILO document Tech Brief No 1 Jim Hamper Paper Peter Bentall Paper July 1993 Namibia Shone Makoriwa report Vasin Gishu Self -Tipping Trailer Trial Jim Hamper Nepal Trailer - Dr T Jones	Literature Review Req'd		MART to carry out review Comments by all to ILO/ASIST on technical brief No1 immediately Published May '96
HITCHING SYSTEMS	ILO technical brief No 1 Jim Hamper paper Bill Hancox paper	Monitoring trials required e. g. Kenya coast		
STAND FOR TOWED ITEMS	No written up documentation	Write up experiences		
WHEELBARROW	ILO Handbook Urban Infrastructure unit Loughborough (Ongoing) IT Transport load carrying devices 1995 Literature review by R. Dennis IT Transport (Bearings and tyres issues) Norconsult modified Armstong wheelbarrow April 1994	Asist will publish Norconsult report + write up experiences	ASIST Finalise Technical Brief MART(ITT) to consolidate data for MART guidelines	
HAND CART	Use of Handcarts in Kisumu - IT Kenya Ron Dennis References			
ANIMAL CARTS	WB 1978 study McCutcheon Walter Illi Feb '89 Kenya Karlsson - CTP 62-64 & 44 Blokhuis '95 Donkey Panniers Barwell IT - Harnessing systems Howe J - Tools & Eqp. Study '83 Starky '85 Animal tractor			

COMPACTION	INFORMATION AVAILABLE	MORE R & D ?	ACTION REQUIRED
PEDESTRIAN VIBRATING ROLLER	Lars Karlsson CTP 44 & 62/63/64 ILO Lesotho seminar 1991 ASIST Seminar 1996 paper Lesotho, Guthrie, SWKP pre 1984 TRL ? Silsoe ?	Review experiences Ghana + Lesotho Further Trials if necessary ITEAN experiences Optimum weight, Minimum weight, Whole life cost, Life span , Cost / Productivity data	MART-ILO to produce a review document of existing experiences Discuss future R & D with TRL/CSIR Issues:- Appropriate Compaction Specifications Compaction Options Performance Costs
TOWED DEADWEIGHT ROLLER	Karlsson CTPs. Kenya Roads 2000 1994 Bangladesh LGED XEN BOGRA Simon Done Silsoe '95 Lesotho database CRRI documents Tractor Attachment India+Ferguson	Review Zambia experiences (Sturla Elvsveen) Roads 2000, follow up Zimbabwe experiences (Review)	
RIDE ON VIBRATING ROLLER	No documentation	Review Ghana (Benford) experiences	
TOWED VIBRATING ROLLER	Lars Karlsson Reports	Review Hydraulic / Engine Vibration systems	
HAND DRAWN ROLLER	Kenya - Jacob Jensma '88 - '91 - Roads 2000 '95 Bangladesh O'Sullivan - ITT	Specifications -corrosion protection -valves -spray bar investigate potential trailer removable tank Document - animal drawn bowers in Kenya	
TOWED BOWSER	Kenya MRP Technical Manual Vol II	Roads 2000 Trials continue	
LADEN TRUCK TRAFFIC	RARP Technology Unit Report	Trial on Effectiveness	
WATER PUMP	Options -Portable Open Impeller -Portable closed Impeller (clean water) Tractor PTO	Review Supplier's Information	
VIBRATING PLATE	Lars Karlsson Report (Specialist use e.g. Urban Block Paving & around culverts)	Review Supplier's Information	
GENERAL	Department of Transport RSA Research on Compaction	Review of all options	

STRUCTURES	INFORMATION AVAILABLE	MORE R & D	ACTION REQUIRED
CULVERT MOULDS STEEL	Steam curing - Malawi Graham Williams ILO guide to handtools Kenya MRP Technical Manual II Norconsult Report on Jig system ASIST document Sept 96 600mm + 900mm	Guidelines on options & costs (under issue) - pipe / box / arch - masonry / brick - corrugated steel - R. conc.	ASIST 1996 Drainage Options document Technical briefs on each option ASIST
CULVERT MOULDS WOOD	Uganda 600mm Odenigbo 1992 KTC currently carrying out trials ILO ASIST document Sept '96		ASIST 1996 document on Steel & Wooden mould systems
PREFAB. FORMWORK	Arch culvert Kenya MRP structures manual Ghana Standard Culvert Slabs - ILO report Mehta		Include in ILO Options Assesment document
CONCRETE MIXER	Labour operated mixer Swaziland For Concrete & Slurry Sealing Standard item	None required	ASIST will obtain Swazi documentation
CONCRETE VIBRATOR	Standard item	None required	
SIMPLE CRANE	ILO Tools & Equipment Royal Engineers' Field Handbook Gin Pole & Shear Legs	None required	
CONCRETE DUMPER	See Dumpers		
CONCRETE PAVER PRESS	Dr. Jones Thailand Kumasi University Research Fly Press I.T. Workshops Press DBSA Cement & Con Association RSA & Australian documents	Trials R&D required Develop moulds Vibration (simple) Testing apparatus	
WATER PUMPS			
HAND OPERATED MOBILE CRUSHER			ASIST will obtain Swazi information

OTHER PRIORITY ITEMS	INFORMATION AVAILABLE	MORE R & D	ACTION REQUIRED
TOWER GRADER	<p>Technology report MRP 1987 Kenya Field Trials Kenya Jemsma 1991 KTC - MOPWH - Kenya Trials 1996 TRL Research report LR91, LR1112 Roads 2000 Reports Petts Jones 1991- Low volume road c. T.Jones Unpaved roads review 1984 Manufacturers data Shrestha Ghana 88/9 DFR</p>	<p>Ghana 6 AG 4000 + 1 Simba Zimbabwe Gitech, DDF Kenya, Tanzania various experiences General review & update on various models - trials - productivity/reliability/cost</p>	<p>TRL link Kenya EU monitoring MART-ILO initiative - Kenya, Zimbabwe, Ghana MART investigate TRL link & TDR bid by July 96 or other funding</p>
TOWED DRAG	<p>OS Road notes TRL LR 1112, RR 91 (Ghana DFR ongoing trials)</p>	<p>DFR write up trials, experiences, design, fabrication, performance, costs</p>	<p>DFR report on trials MART consolidate this & existing TRL data</p>
BITUMEN HEATER	<p>ILO Handtools Manual CRRI ? CSIR ? Transportation Research Board National Academy of Sciences Report 12, Washington 1980 Sabita Manuals 11 & 12</p>	<p>Review Document Disseminate</p>	<p>MART</p>
BITUMEN HAND SPRAYER	<p>Standard Production Item</p>	<p>Review Document Disseminate</p>	
FUEL BOWSER	<p>MRP Technical Manual Vol II</p>	<p>None required</p>	

7. CLOSING COMMENTS

Before the official closing of the workshop and the expressions of gratitude to the organisers and participants, the participants were given the opportunity to make any further comments relating to the workshop and its follow-up. The following comments were made:

- Training is required on the handling and management of intermediate equipment for contractor's personnel.
- When new equipment is delivered, there should be pre-delivery training of operators and mechanics. The cost of this training should be allowed for.
- Manufacturers should be encouraged to understand the equipment needs of the LB roadworks sector and to cooperate with LB programmes in the development and testing of intermediate equipment.
- Practitioners should feed back experiences of technical problems to the equipment manufacturers, to enable improvements to be made.
- The MART questionnaires will be an important feedback on the experience of LB projects.
- The possible roles of universities and training institutions in equipment R&D should be investigated.

8. NEXT STEPS

A. INSTITUTIONAL ISSUES

As the MART initiative proceeds, conceptual papers and case studies will be generated in order to provide a broad perspective on institutional issues related to intermediate equipment. It is intended that these items should eventually be consolidated to provide a comprehensive overview of action required in order to secure a productive environment which will encourage continuing development of appropriate equipment. MART's work on institutional issues related to intermediate equipment will link closely to handtools and the promotion of the private sector. MART also recognises the need to coordinate closely with other organisations with an interest in institutional issues, including the ILO, the World Bank, international assistance agencies and the World Road Association (PIARC).

B. OPERATIONAL ISSUES

GENERAL

B1 MART/ILO to discuss proposal to prepare a working paper on equipment selection, procurement, management and support.

B2 ASIST/MART to collaborate on plan of action for preparation of technical briefs on individual equipment items.

B3 A document describing the experiences of procurement of intermediate equipment, its use and mechanical support in Ghana to be prepared as a case study by Soren Fosberg, DFR. This document will act as a model for further case studies to generate productivity and operational data.

HAULAGE

B4 MART to carry out a review of trailers.

B5 ASIST to finalise and distribute Technical Brief No 1 (Standard Trailer and Hitch).

B6 Charles Williams to prepare a discussion paper on stand for towed items.

B7 ASIST to finalise Technical Brief on wheelbarrows.

B8 MART (I T Transport) to consolidate data for guidelines on wheelbarrows, handcarts and animal drawn carts.

COMPACTION

B9 MART/ILO to discuss proposal to prepare review document on experiences with pedestrian vibrating rollers and other compaction equipment.

B10 R&D requirements to be discussed with TRL/CSIR and other interested organisations under the headings:

- Appropriate levels of compaction for labour-based roadworks
- Guidelines for preparing appropriate compaction specifications
- Compaction options
- Generating realistic performance and cost data.

STRUCTURES

B11 ASIST to publish a document on options for small drainage structures (by end 1996).

B12 ASIST to formulate future work programme for technical briefs on individual drainage options.

B13 ASIST to publish document on steel and wooden culvert mould systems (by end 1996).

B14 ASIST to obtain information from Swaziland on hand operated concrete mixer and hand operated mobile crusher.

TOWED GRADER

B15 Following a review of existing information, MART to discuss with TRL the preparation of a 1996 TDR bid based on R&D and field trials in (tentatively) Ghana, Kenya and Zimbabwe.

TOWED DRAG

B16 DFR, Ghana to write up experiences of ongoing trials (design, fabrication, performance and cost data) for MART to consolidate with existing TRL data.

BITUMEN HEATER AND HAND SPRAYER

B17 MART to prepare review document based on existing information. MART will also run an equipment challenge competition to design a bitumen heater-distributor.

FUEL BOWSER

B18 MRP Technical Manual Vol. II has hitherto been distributed by ASIST. However it is now out of print. ILO/ASIST to determine copyright issue and arrange for reprinting if possible.

CONCRETE PAVER PRESS AND TESTING EQUIPMENT

B19 Designs and trials are required to develop manually operated concrete paver presses for manufacturing concrete paving bricks by small enterprises for urban and village application. A simple field system of testing the strength of pavers is also required. MART will run an equipment challenge competition to design a concrete paver press and testing equipment.

NOTE:

Some of the foregoing actions have cost implications which cannot be met with the existing resources of MART, ILO or other partners. Where necessary, project proposals will be prepared once work programmes can be defined and quantified.

C. TRAINING

Participants highlighted the dearth of basic information, manuals, case studies, performance and cost data for use in teaching and training as well as project planning, regarding intermediate equipment. The lack of opportunities for training and professional development in the procurement, use and maintenance of intermediate equipment is seen as a severe long term constraint to sustainability of the technology. Although training issues could only be briefly reviewed in the course of the Accra workshop, both MART and ILO recognise the need to emphasise this aspect of dissemination. The preparation of a plan of action should be facilitated by inter-university network contacts and the emerging results of the proposed R&D programme under sections A & B above.

Annex 1

Workshop Programme

Day 1

08.00-08.30	Registration	
09.00	Official Opening	Mr. C. D. Antwi
09.15	Introduction, The Workshop & Programme, arrangements	Messrs Miles and Williams
09.30	Objectives, Introductions, Process, Expectations	Derek Miles
10.30	Coffee / Tea Break	
11.00	ILO-ASIST Objectives and Role	David Mason
11.15	MART Objectives and Role	Robert Petts
11.30	ILO-MART Questionnaire results	Paul Larcher
11.45	BPWA Paper competition and review	Derek Miles
12.00	Introduction to Intermediate Equipment Issues	Robert Petts
12.15	Questions and Discussions on Presentations	Plenary
12.45	Discussion and identification of issues for working groups	Plenary
13.00	Lunch	
14.00	Presentation on towed graders	Gavin MacKay
14.15	Continue Discussion and identification of Issues	Plenary
15.30	Coffee / Tea Break	
16.00	Working Groups - topics could include	
to	<ul style="list-style-type: none">• Issues and items of equipment to be covered by the	
18.00	guidelines	
	<ul style="list-style-type: none">• What information is available• Items on which we have useable designs/specifications• Items on which more R&D work is required - prioritised• Actions required to promote R&D, standards and availability of intermediate equipment• Guidelines on specification, procurement and management of intermediate equipment	

Day 2

08.30	Continue working group discussions	
	Action Plan	
	Draft Outline of Intermediate Guidelines Table of Contents	
17.00	Official Closing	Derek Miles & David Mason

Annex 2

OPENING ADDRESS

**MR. C.D. ANTWI,
DIRECTOR OF THE DEPARTMENT OF FEEDER ROADS**

Mr. Chairman, Distinguished Guests, Ladies and Gentlemen, I wish to express my sincere gratitude to the organisers of this Seminar for inviting me to give the keynote address on this very important occasion, to take a critical look at matters relating to the labour-based small-scale contracting industry in general.

I would also wish to take this opportunity to welcome those of you who have travelled from far and near to attend this august seminar, which is dear to the hearts of the Government of Ghana, the Ministry of Roads and Highways and the Department of Feeder Roads.

As you are all aware, the objective of the seminar is to provide detailed recommendations in the action plan regarding the production of a document setting out guidelines for intermediate equipment for Labour Based Small Scale contracting for the road sector.

The scope of the ensuing document should cover both the rural and urban centers. This is the first attempt at providing a document to provide uniform guidelines to the much touted labour based small scale Industry relating to equipment.

Mr. Chairman, Ladies and Gentlemen, I find the objective of this seminar very appropriate especially as related to the guidelines affecting intermediate equipment for Labour Based Small-Scale contracting industry, at this time in our development, and for that matter all developing economies.

Mr. Chairman, distinguished ladies and gentlemen, in the transfer and absorption or adaptation of any type of technology there are certain factors that should be taken into consideration. These factors may include the following:

1. the new technology should not interfere or contradict with the cultural pride and patriotic urges of the beneficiaries.
2. the technological changes should be reasonably ambitious and progressive in character.
3. technological changes should avoid fragmentation of human faculties and promote creativity,
4. technological changes should be supported by appropriate organization and socio-economic factors.
5. technological growth should not lose sight of small and medium scale industries. And this I believe is what this seminar eventually aims at.

Ladies and gentlemen, transfer and assimilation of technology is an integral part of national development involving the same basis and infrastructure. The successful transfer and assimilation of technology is directly related to the absorptive, reproductive and innovative aspects of national technological framework.. It should be acceptable and also conform to the general national vision, aspirations and objectives.

A technological framework is, however, sustained by a socio-economic framework particularly, its all-important human elements. When therefore one talks about intermediate technology for developing economies, this becomes very relevant in the context of acute shortage of capital and surplus unemployed labour.

In many of the developing economies, technological excellence could be maintained by substituting capital with labour up to a technically feasible breakeven point. Beyond this, the employment of too many people begin to take toll upon the technical efficiency and profitability. Every type of technology has a saturating point for effective and economic use of labour. In selecting equipment in the contracting, the human element and the capacity to adapt and adopt should not be overlooked.

Mr. Chairman, Distinguished Guests, Ladies and Gentlemen I have made an attempt to point out some of main criteria for technology transfer, I would wish to make a cursory remark that Ghana is poised to accept and assimilate the appropriate intermediate technology so as to enhance the development of roads in the country.

Development of roads to all intents and purposes is a capital intensive venture as those of us in the current age have seen over the years. Therefore, in an economy like ours we need to find a mean between intense capitalization and surplus labour. At this juncture, I will wish to share briefly the Ghanaian experience with you.

Ghana as a country has created the enabling environment to accept both small and medium scale technology in the road sector. The institutions are available, the skills are there and the Socio-political will is also assured. Ghana's experience in this area could therefore be exploited for the preparation of this document.

Mr. Chairman, Ghana, like many developing countries, is characterised with the problem of deteriorating economic conditions, a crippling scarcity of foreign exchange and an abundant supply of cheap labour. Efforts have, consequently been directed to developing and disseminating technologies which made more effective use of local resources (particularly human resources). As part of its efforts to improve rural access in Ghana, the Department of Feeder Roads has adopted the labour-based technology. This strategy involves training and equipping of small and medium sized local contractors to enable them undertake road rehabilitation and maintenance activities using a mix of selected plant/equipment and employing a lot of labour that have been found more appropriate. In our efforts to adopt the appropriate technology for the enhancement of our developing economy, the UNDP through ILO has been of much assistance in this direction. Mr Chairman, ladies and gentlemen we salute them.

Mr. Chairman, Ladies and Gentlemen, the UNDP through the ILO have been the major agencies which has propelled the labour intensive programme to its present status. Under the pilot project the World Bank also provided the funding for the light construction equipment to be used by the contractors, as well as the costs of the project. The Government of Ghana contributed local costs and provided the counterpart and support staff for the project.

This Pilot Project was first established in 1986 in the forest areas of the Western Region with Sefwi Wiawso as the center of operations. This is a major cocoa growing area producing around 100,000 tonnes annually. The severe climatic and topographic conditions ensure some of the worst feeder roads in the country. This is a rather very high rainfall area with usually only two dry months. If the project succeeded in this very difficult terrain, then it would work anywhere.

The project did succeed and other areas were also taken up. I therefore pause to state that the merits and demerits of Western Region experience in Ghana could be analysed in detail to assess the type of equipment that were used in the difficult terrain. This study is important to enable us avoid all the pitfalls and capitalise on the positive aspects.

The labour intensive programme has been so successful that over 1400km of roads have been constructed whilst more than 93 small-scale contractors have been trained of which 54 are fully equipped. Meanwhile, there are 356 applicants in waiting to participate in the programme. Other contractors registered with the Ministry of Works and Housing having realized the importance of the labour-based programme, expressed interest in having their staff trained.

Mr, Chairman, it must be noted that the training included the use of light equipment. After completion of the contractors training, the ILO team together with the DFR Engineers continued to provide technical advice and close supervision of the trainees' work until 1990 when they handed over completely to our Local Engineers. The Department of Feeder Roads still has an ILO Training Adviser with us helping with our general training and development programmes.

Mr. Chairman, Distinguished Guests, Ladies and Gentlemen, the relevance of this seminar can be seen in the lenses of the Ghanaian success story. Although the programme has seen marked improvement one cannot claim excellence, there is still room for improvement. It is assumed that when there is improvement in equipment and tools, the modus operandi of the system will also assume the same dimension.

Mr. Chairman, those gathered here are mostly professionals who have a common objective to improve the prevailing Labour Based System. Participants from other Countries and with national experiences will have

serious bearing on the outcome of this seminar. I entreat you to interact freely without reservations or hiding anything under the carpet.

Fortunately, the experiences we have are mostly in the African region where work cultures are not diametrically opposite but are closely interrelated. These are the advantages that we have to exploit to come up with a more cogent and futuristic document which will stand the test of time and be acceptable internationally.

The other point worthy of notice is that this seminar should recommend equipment that may be easily maintained and managed, with the least of skills. You should also relate to equipment that may have local capacity for production and maintenance in terms of availability of plant. The seminar may consider improvement on existing hand tools, simple implements and even other non-motorized means of transport so as not to come into conflict with other traditional norms that may hinder the progress of the labour intensive programme.

Mr. Chairman, I wish all participants who have travelled from outside the country to attend this seminar a happy stay. It is my wish that they will have good sampling of the proverbial Ghanaian hospitality.

I wish you all the best in your deliberation and hope that in the end, we all have lasting document to guide us in the provision and management of intermediate equipment in the Industry.

Thank You.

Annex 3

Expectations of Workshop Participants

- Expert data is available, we need to stop reinventing ‘the wheel’
- How should LB contractors compete with equipment based contractors
- Produce equipment specifications
- Gain information on training issues
- Share expertise on graders
- Produce proper costing procedures
- Obtain feedback from those participants working ‘in the field’
- Improve strength of equipment materials
- Discuss training issues
- Investigate the possibility of developing a research centre
- Discussion on the specification, design and manufacture of equipment
- Produce definitive equipment designs and specifications which may be confidently offered to third parties
- Information is available in many different documents - collate it into one manual
- Produce guidelines which are ‘simple, direct and to the point’, that would avoid any pitfalls
- Advice for Project Managers on equipment to keep it running
- Exchange equipment ideas
- Obtain information on equipment for use in highway engineering course
- Produce a list of essential equipment that is required
- Gain information on machinery and tools to pass on to other contractors
- Share experience of equipment use
- Develop a more cost effective operation
- Guidelines on procurement
- Guidelines on local manufacture (including quality control)
- Guidelines for assessing and monitoring performance of equipment in the field
- Facilitate exchange of ideas

Annex 4

ILO/ASIST — Objectives and Role

Background

ASIST stands for Advisory Support, Information Services and Training. The ASIST project evolved from the post of the ILO Regional Roads Adviser, based in Nairobi, Kenya. The first phase of ASIST was set up to run from July 1991 to August 1994, with funding from the Government of Norway, the Swedish International Development Authority (SIDA) and the Swiss Development Cooperation (SDC). The same three donors have continued funding for the second phase which runs from September 1994 to December 1996.

The project is operated under the auspices of the ILO's regional structure for Africa with technical support from the Development Policies Branch (POL/DEV) in Geneva, and in close cooperation with the ILO's Multi-Disciplinary Advisory Team in Harare, Zimbabwe.

Development objective

The development objective of ASIST is to achieve a wide-scale adoption of employment-intensive approaches in national transport and infrastructure investment policies and programmes.

This is within the context of the ILO's programme to promote employment-intensive investment policies as a strategy to alleviate poverty.

Immediate objective

The increased use and efficiency of labour-based methods to carry out road construction and maintenance activities in the project's area of influence.

Structure

In order to meet the immediate objective, the project was divided into three components, as implied by its acronym: advisory support (technical and policy advice, and project backstopping), information services (networking, technical enquiry service, publications, research), training (international courses for engineers, senior technicians and trainers).

The role of ASIST in respect of intermediate equipment for labour-based small-scale contracting

Information services

- Standards and designs for roads, structures, equipment and tools
- Sources and suppliers of equipment and handtools
- Ongoing research.

Standards and designs for intermediate equipment

- The aim is to make available to practitioners tried and tested designs for equipment to support labour-based methods of road construction, rehabilitation and maintenance

- We have collected material from around the world and this is catalogued in our commercially-available document database called ASISTDOC (on sale next week)
- We have published designs and specifications for a standard 3m³ trailer, and a second (revised) edition is due out very soon. This is the result of many years of development in Kenya
- In the pipeline are technical briefs on wooden culvert moulds (developed and used in Uganda) and steel culvert moulds (from Kenya).

Standards and designs for handtools

- The same applies to handtools. ASISTDOC contains 95 references on handtools
- ASIST helped the Kenyan Ministry of Public Works to publish a technical manual that included specifications for handtools
- In preparation is a technical brief on wheelbarrows (a design by Armstrong, modified by Norconsult).

Sources and suppliers of equipment and handtools

- The Document Centre collects and catalogues designs and specifications from manufacturers of tractors, tractor-drawn equipment and handtools, and small self-propelled equipment such as pedestrian rollers

Research

- While not having funds to commission research, ASIST encourages and monitors research done by third parties
- In collaboration with the Department of Staff Training (Kenya) and the Jomo Kenyatta University of Agriculture & Technology, ASIST oversees research carried out by Swiss students at Kisii Training Centre. Over the past three years, these students have investigated handtools management and maintenance (this is an issue deemed to be of more interest to contractors than to force account operations); compaction; and the performance of hand-drawn rollers. This year they will look at tractor-drawn rollers
- Collaboration between the ILO and African universities promotes research: *e.g.* JKUAT research into effectiveness of tractor-drawn rollers.
- ASIST has an agreement with MART to collaborate in research in the fields of intermediate equipment and handtools.
- ASISTDOC includes reports of research conducted by various organisations such as TRL; Ministry of Public Works Technology Unit, Kenya; University of the Witwatersrand, South Africa
- ASIST collects experience from projects and users about equipment and handtools

The way ahead

Intermediate equipment

- We think we have a good product in the standard trailer and hitch (Technical Brief No 1)
- There is still work to be done on equipment for compaction: we should like to be able to offer standard designs for hand-drawn and tractor-towed rollers
- We await the results of trials on towed graders being carried out by the Ministry of Public Works in Kenya
- Trials are continuing with various designs of culvert moulds. We expect to offer designs for both wooden and steel moulds as tried and tested products, but not necessarily to be regarded as 'standard'
- Very little work has been done on intermediate equipment management

Handtools

- There doesn't seem to be much interest in handtool research at present. This may be a hangover from the force account system where there was no real incentive to use and maintain good quality handtools. Government procurement procedures often make it impossible to obtain quality products

- However, with the move to contracting, the quality and management of handtools ought to be of concern to a cost-conscious contractor
- Plenty of designs and specifications exist already, but it is difficult to find manufacturers who can meet them
- There has been very little research into handtool management, and this is an area where we should like to see published guidelines for users