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SESSION 1: INTRODUCTION TO THE CONSULTATION

I INTRODUCTION

This consultation was conducted in the Maluti Hotel, Mophale's Hoek, Lesotho, and took place over three days from 3-6 March 1997.

The consultation is the second in a series of reviews of current practice in labour-based technology. These have been organised and conducted by the ILO project ASIST which is responsible for the promotion of this technology in Sub-Saharan Africa.

The primary purpose of the review was to look for ways of improving the application of labour-based methods in road construction and maintenance in the region, by bringing together experts and practitioners to discuss common problems and solutions.

Representations were invited from all the major programmes in the region, and a list of the 36 participants is given in Annex 6. Of the above, 14 were ILO experts but the majority were government personnel, technical assistance staff from other agencies and interested consultants. It is hoped that this trend of increasing expertise from outside the ILO will continue.

The proceedings closely followed those successfully used for the first review which was to call for short papers on key topics, which were then extensively discussed and written up in the proceedings.

Topics covered by the first review were:

- Low cost structures
- Control of alignment
- Haulage of materials
- Self help
- Training materials
- Maintenance
- Worker motivation
- Monitoring and control

The second review concentrates on fewer topics, grouping all the papers into five sessions with more emphasis on services to be provided to the region by ASIST. The contents of these sessions are summarised below.

Maintenance:

This session draws on three papers from Kenya and emphasises the difficulties of introducing sustainable maintenance procedures, which has proved much more difficult than in the field of construction.

Contractors:

The move away from government direct labour implementation is becoming increasingly important and the three papers in Session 4 and Annex 4 illustrate the key issues in two successful programmes in the region to date, under the direction of the Department of the Feeder Roads in Ghana and the Ministère de

Travaux Publics in Madagascar.

Compaction:

The most effective method of compaction to compliment the labour-based approach has still not been fully resolved. In this session experiences are presented from Ghana and Kenya, together with a research proposal from the University of Dar es Salaam.

International Labour Standards:

Although one of the major benefits of the labour-based approach is the creation of employment, it is essential to ensure that working conditions are in line with agreed conventions and that fundamental human rights are not violated. Experts for the ILO explain the relevant ILO standards and discuss how they can be applied in labour-based programmes.

Technical Enquiry Services:

The ILO project ASIST is mandated to provide advisory support, information services and training to the region. One of the primary activities is collecting, collating, researching and distributing relevant information. This review provides the first forum to try to focus this major task into something manageable and useful for the recipients. This session presents the background to the service proposals and the priorities and action agreed in the discussions.

Plan of Action:

Throughout the sessions a record was kept on actions to be taken. These points were further discussed at the end of the review and prioritised for ASIST follow up. Readers with queries or contributions on these subjects are encouraged to contact ASIST.

Site Visit:

The participants had the opportunity to visit some of the activities of the Labour Construction Unit Project (LCU). This project is one of the earlier labour-based projects starting in 1977, and operates in one of the most difficult terrains, with steep gradients, large quantities of rock work, highly erodible soils and poor quality gravels. The project has evolved its own unique methods to cope with these problems and demonstrates the feasibility of cost effective and high quality labour-based work in this difficult environment.

II. STRUCTURE OF THIS REPORT

This report follows the order of the sessions as they took place during the meeting. Each session is introduced by a summary of the papers presented. Subsequently the ensuing discussions are summarised. The summaries of the discussions are presented in italics type fonts.

The Annexes of this report contain topic papers prepared for the consultation but which were not presented during the consultation. Nevertheless, they have been included in this report since they are highly relevant to the various topics covered.

III. ACKNOWLEDGEMENT

The ILO/ASIST secretariat to this consultation appreciate the crucial assistance they received from the LCU-Lesotho Project Staff in organisation and support of the 3 day event.

THE Labour Construction Unit who hosted the consultation would like to thank the participants for their effort to travel and contribution to this consultation, and their employers for allowing for their absence and travel costs.

SESSION 2: SITE VISIT TO LABOUR-BASED ROAD PROJECTS

The site visit started with a short visit to the regional headquarters of the Labour Construction Unit (LCU) in Mohales Hoek where the project staff gave a brief introduction to the roads visited and the ongoing activities in Region South.

MAPHUTSENG - HA SELEMO - HA MONEHELA

This project consists of the upgrading of a 9.5 km motorable track and thereafter a 6.5 km trail to an all weather gravelled road with a 6 m wide roadway. The road goes through mainly rolling terrain with an average daily traffic of 30 vehicles serving a fertile area with a population of approximately 600 persons per kilometer.

Design Standards

The design complies with the Design Guidelines for Low-Volume Roads in lowland/rolling terrain. A 6 m wide camber is constructed with a crossfall of 8 % allowing for a consolidation during the construction period to 5 %.

Figure 1 shows a cross section of the standard road design in rolling terrain.

Structures

The road alignment requires two major crossings of the Maphutseng river. The first of these crossings have been completed which consists of a vented ford of 42 concrete culverts with two spillways and a continuous reinforced concrete slab (see figure 2). The total length of the crossing is 55 m. A similar crossing is planned at km 9.600.

In addition, a total number of planned structures is as follows:

- 5 vented fords
- 14 slab culverts and
- 65 drifts.

The labour-based road programme in Lesotho make use of natural stone when constructing their drainage structures. Apparently there is a good supply of skilled masons to undertake these works (see figure 3).

Work Methods

The project is executed using labour-based methods with the assistance of light equipment for compaction and hauling of gravel and water.

All eartheors are carried out by manual labour. Excavation of drain, installation of culvert pipes, and mixing of cement mortar is done by hand. Gravel transported by tipper trucks but excavated loaded and spread by labour. The compaction is done with Bogmag 90S 1.25 tonne pedestrian rollers.

Gravel sources was found on the existing road alignment.

Costs

The total estimated costs of this project, including structures and administration, amount to 156 000

M/km (=54 000 US\$/km). The labour input is estimated to 3600 workdays/km amounting to 27 % of the total project costs.

Compared to other labour-based projects in the region, the daily wage rate for casual labour is relatively high in Lesotho, namely 12 M/day (= 4.15 US\$/day)

OLD HOEK - HA LEHLOIBI

Construction on this 6.4 km road started in February 1991 and was completed in September 1991. The road is constructed through partly mountainous terrain with a formation width of 6 m and a gravelled carriageway of 5 m. The total number of structures is 8 culverts and 14 drifts.

The average labour input was approximately 2500 workdays/km which amounted to 55.5 % of the total project costs.

The road has been put under routine maintenance by lengthmen. Apparently this was working successfully. Although the road runs through difficult terrain with very steep sections, it was in a very good condition.

SESSION 3: MAINTENANCE

Summary

Maintenance is steadily gaining the recognition it deserves for governments and development agencies. Due to financial constraints, organisational problems and inappropriate methods, condition of roads have deteriorated since the 1960's to the extent that it is a threat to the economic development in rural areas. So far labour-based methods for routine maintenance have proven to be most appropriate for rural roads, but their large scale application still requires significant planning, training and management inputs.

In Kenya, labour-based methods have been applied for 20 years on the rural roads network and experience is more extensive here than in other countries.

The performance and means of improving the established system is presented by Gary Taylor. The difficulties of changing an established system to a more efficient one, are reviewed by David Jennings. Through a presentation of the Roads 2000 project, Andreas Beusch explains how the use of labour-based methods will be expanded to cover maintenance works on all gravel roads in Kenya also including those which have been constructed by equipment-intensive methods.

- I. [Improving Routine Maintenance by Lengthmen: A Technical or a Managerial Problem?](#) - by Gary Taylor
- II. [Training for Changes in Routine Maintenance](#) - by David Jennings
- III. [Appropriate Equipment for Maintenance](#) - by Andreas Beusch

I. IMPROVING ROUTINE MAINTENANCE BY LENGTHMEN

A TECHNICAL OR A MANAGERIAL PROBLEM?

Presented by: G,A. Taylor, PEM Engineer, MRP Kenya

In this short paper; the development of the lengthmen system of routine maintenance as practiced in Kenya will be briefly described. The main findings of various studies on the system to date will be reviewed. Finally some problems with the system as currently operated will be given to provide a starting point for further discussion.

The lengthmen system of routine maintenance has been operating in Kenya on unpaved rural roads since the mid to late 1970's. Despite many questions over its effectiveness and suggestions for change; it operates today in basically the same form as fifteen years ago. One lengthmen (or "length person") is responsible for the maintenance of a section of road of about 1.5 km length. Currently approximately 9,000 km of road are under routine maintenance by slightly over 6,000 lengthmen of whom 88% are men and 12% women.

Each lengthmen works for 3 days per week throughout the year. One overseer equipped with a motorcycle supervises about 100 lengthmen. He is expected to visit each road section at least twice a month to monitor work carried out and plan future work. There are an average 3 to 4 overseer per district who report to a maintenance inspector. The maintenance inspector has responsibility for all maintenance operations (both routine and periodic) in the district.

In the early 1980's it was felt that a more rational and scientific approach was required. Consequently a series of studies were initiated in order to devise procedures for calculating the labour input needed to maintain a road under different physical conditions. To date three important studies have been completed:

1) Maintenance Study 1.

Kenya Rural Roads Maintenance Study by Ove Arup and Partners commenced in early 1985 and the final report was completed in 1987. This study observed and analysed the routine maintenance work actually carried out on 15 typical rural access roads over a period of one year.

2) Maintenance Study 2; phase 1.

The Establishment of Routine Maintenance Productivity Standards by Howard Humphrey and partners commenced in September 1988 and the final report was completed in May 1989. This study establishes appropriate task rates for routine maintenance operations from 5 months of detailed site measurements (see table 1).

3) Maintenance Study 2; Phase 2.

The development of Routine Maintenance Requirements by Scott Wilson Kirkpatrick commenced in February 1990 and the final report was completed in October 1991. This study sought to identify relationships between routine maintenance requirements; in terms of labour inputs; and local factors such as rainfall; traffic and soil type. Observations were taken on 50 sections of minor/rural access roads over a period of one year during which time the inputs were carefully directed.

In addition to the above studies; various investigations have been carried out by the MRP Training School at Kissi and internal discussion papers on routine maintenance have been produced by MRP Staff.

The most significant conclusion to emerge from the studies to date is that management factors (planning; supervision; and motivation) have far more influence on the effectiveness of routine maintenance by lengthman than any technical; climatic or other factors.

In the most recent (SWK) study it was found that; despite a relatively high level of supervision; the actual individual productivities of lengthmen could readily be up to five times lower than the standard task. This tended to dwarf variations due to physical and environmental characteristics of the road sections.

Before running to this point the conclusions drawn so far on technical points will be summarised.

It has been established that rainfall is the most important single cause of degradation of unpaved roads. Rainfall quantity influences the amount of siltation and erosion that occurs in ditches and the amount of erosion of carriageway and shoulders. The number of rainy months influences the amount of grass and bush cutting required.

An interesting finding has been that certain routine maintenance carried out in very dry weather actually damages the road. Following on from this it has been suggested that; on balance; it is better to suspend routine maintenance work for most of the dry season.

Perhaps the most surprising result arrived at so far is that no general quantitative relationship between

traffic and overall maintenance inputs has been found. This is despite the fact that roads with relatively high traffic levels (several hundred vehicles per day) as well as low trafficked roads were included in the studies.

Similarly no clear relationship between surface material type and overall maintenance inputs has been found. Gravel and earth roads did not require significantly different maintenance input in dry weather. However; in very wet weather earth roads with moderate to high traffic deteriorated so fast that the lengthmen had difficulty in keeping up with the carriageway maintenance.

Also; there has been no relationship found between soil (subgrade) type and maintenance inputs. However; soil type did vary with climatic zone and; as mentioned above; climate was found to have a major impact on maintenance requirements.

The distribution of activities required showed some variation between two of the main studies carried out (see figure 1). However; both studies found that cleaning side ditches was the major single routine maintenance activity required and carried out. This activity accounted for about 25% of all labour inputs to routine maintenance. Very approximately 45% of routine maintenance input requirements were found to be concerned with drainage works; 40% with carriageway and 15% with other works such as bush clearing and grass cutting.

Based on these studies a method of calculating annual labour inputs for a section of road based on its characteristics has been devised. The results are inevitably an approximation but further sophistication is probably not warranted (see tables 2-4).

Returning to the managerial issues; there is clearly a problem with the lengthmen system in terms of supervision. The dispersed nature of the work results in very diluted supervision. It was calculated in one investigation that an overseer had; on average; only 9 minutes to spend with each of his lengthmen on each visit. This obviously leaves little for detailed instruction or training of lengthmen (see figure 2).

The general supervision problem has been assisted to a certain degree by the instruction of the routine maintenance headmen in charge of up to ten lengthmen each. However; the issue of some grouping together of lengthmen continues to be put forward. But to what extent this can be done without incurring the disadvantages of conventional routine maintenance gangs is still not clear.

A further problem is that routine maintenance overseers themselves do not have clear targets to work to; unlike a road construction site. Monitoring of routine maintenance output is also a problem which tends to lead to neglect of this section of work by senior personnel in favour of supervision of more concentrated construction activities.

Target setting and monitoring of routine maintenance is definitely required. Target outputs should desirably be expressed in terms of the condition of the maintained road. However; there is no easy and accepted method of measuring the "condition" of an unpaved road. Roughness measurements tend to be unreliable and anyway only measure the carriageway condition.

In Kenya a "road defect rating" based on a combination of carriageway and drainage works condition is used (see figure 3). However; in practice it has been found that two different inspectors can arrive at very different defect ratings for the same section of road. A satisfactory solution to this problem has yet to be found.

Despite these problems all the studies have found that the lengthmen system of routine maintenance is a relatively successful system for unpaved rural roads in Kenya. However; the potential for improvement is believed to be quite significant. It has been suggested that current overall productivities are only 50% of what is theoretically achievable. The challenge now is how to realise these potential improvements with effective and appropriate low cost measures.

DISCUSSION

In Kenya there are currently approximately 9000 km of roads under routine maintenance carried out by slightly more than 6000 lengthmen. Each lengthman is given the responsibility of an average 1.5 km of road.

The average cost of this maintenance set-up is US\$ 200/km/year where 65% of the costs are labour wages, 12 % supervision and 20 % transportation.

From the studies carried out on the Minor Roads Programme Programme (MRP) one can conclude that 45 % of the maintenance input requirements are concerned with drainage works, 40 % with the carriageway and 15 % with other works such as bush clearing and grass cutting.

Management

Although the lengthmen system of routine maintenance is a relatively successful system, it is believed that the potential for improvement is significant. However, the conclusion from the studies is that improving planning, supervision and motivation is far more important to the effectiveness of the programme than technical or other factors.

To improve the supervision of routine maintenance, headmen were introduced to facilitate communication between the overseers

II. TRAINING FOR CHANGE

Presented by: D.W. Jennings Bsc. C. Eng. MICE. FIHT.

Project Manager KTS. Labour - based Roads, Training Project, Ministry of Public Works, Kissi, Kenya.

Background.

The Rural Access and Minor Road Programme (MRP) of the Ministry of Public Works of Kenya have been constructing and maintaining Access and Feeder Roads in twenty six Districts of the republic of Kenya.

This programme have been very successful. The success is due to many contributing factors, not least of which is a comprehensive training programme for staff. The detailed training received by all MRP supervisory staff through courses conducted by the school since 1978, means that the MRP has a very high quality of staff. The staff at all supervisory levels have a sound knowledge of technical, organisational and operational matters.

The MRP system of construction and maintenance is based upon standardised method which are instilled in each individual through training and exercising. This is very successful and the programme works well in this way.

The programme has built up a tradition in the way that the jobs are done. This tradition is known and used throughout the country for labour-based road maintenance. This is good. It is the basis of the success of MRP and its political acceptance in the country. It works.

This programmed tradition, which has been deliberately built up in the system, is also the reason why change is difficult to effect.

The Case Study

With the change from Rural Access Road to Minor Roads (unclassified to classified), it was realised that a number of changes would be needed to the system.

One of the latest of the major changes was change in the routine maintenance system. Whilst the original routine maintenance system worked reasonably well, it was felt that many improvements could be made. A consultant with experience of the system was engaged to propose changes to the routine maintenance system.

First Draft of the New (Interim) Maintenance System (IMS) document was produced in April 1988.

This document describes in detail all aspects of the required maintenance of earth and gravel roads by labour-based methods where labour availability is high.

The document was copied for comment to all MRP engineers (approximately 30 persons). The comments on the document and its contents were discussed in the MRP Engineers Meeting of October 1988.

The engineers having no comments on the document, the management of MRP determined to approve the document and instructed the Engineers to begin implementing road maintenance work according to the new (IMS) system. This can be called round one.

The result of round one can be summarised quite briefly.

NO ACTION WAS TAKEN!

ZERO PERCENT IMPLEMENTATION WAS ACHIEVED.

The Training Department of the Ministry and especially the Kisii Training School had prior knowledge of the contents of the IMS manual. KTS has prepared, with the help of the external consultants, training courses to fit the IMS.

The courses were conducted intensively throughout 1988 and the first half of 1989.

Courses were conducted on a regional basis and followed up immediately by instructors' visits to districts. During the follow-up the instructors helped the overseers to set up demonstration sites and begin to train the lengthmen.

Courses were conducted separately for instructors and overseers from each of the four regions of the MRP.

By the middle of 1989 all the districts of MRP had inspected and overseers who had been trained in the new (IMS) methods. This was round two.

The results of round two can also be summarised briefly.

NOTHING HAD CHANGED IN THE FIELD!

ZERO PERCENT IMPLEMENTATION HAD TAKEN PLACE

This gradually became obvious during 1989. By the time of the Joint Donors Meeting in November 1989, the MRP management was highly concerned. Not only had the robust efforts of the training school ostensibly failed to make any difference, but the managements direct instructions to the District Engineers had been ignored.

The issue was seriously discussed during the Donors Meeting together with the donors and the relevant departments of the Ministry of Public Works. It was realised that the inertia of the traditional system was far greater than had been anticipated. More efforts were needed. More resources had to be allocated to the problem. A more radical approach was required.

Round three began early in 1990. Outside help was engaged in the form of a donor funded consultancy for implementation of the IMS. The terms of reference for the consultants were formulated in such a way as to make it clear that the task was to change the field practise in all districts, and not just make demonstration or train individuals.

The consultant worked closely with the Kissi Training School and together they designed a new round of training for all districts.

These courses were now conducted in the field regions.

The courses were conducted with the participation of operational units. That is all members of the unit, engineer, inspector and overseer were trained together.

Modern training techniques, including problem solving approach and group work with strong visualisation were used.

The operational units were given the group task of foomulating their own implementation plans for their units, then putting these plans into practise.

The consultants together with the Kissi Training School conducted these courses in each region during 1990. Having forced the formulation of realistic implementation plans from each unit, the consultant made a programme of monitoring visits to every district. The monitoring programme of the consultant and his report were made known to the District Engineers. The MRP management also followed up the results of these monitoring reports and discussed any problems with the engineer concerned.

This process took until mid 1991. From the consultants final report we can see the results of round three. Country wide the average implementation is approximately 50 %. Some districts now have 80 % implementation.

The operating units have taken on the task of completing the implementation for themselves and resistance is no longer a problem.

Finally, after more than three years since the document was produced, we are coming close to having implemented the change. It has taken a considereable amount of money, and a great deal of time. It could have been done quicker, and cheaper.

Conclusion

1. The effort required to implement change to an operating system should not be underestimated.
2. The resistance to change from the staff should be taken into account in all training sessions which involve changes to a working system.
3. All three aspects must be considered when training adult professionals. They are Knowledge, Skills, and ATTITUDE. When change is involved the most important of these three may well be attitude.
4. Modern training techniques for the Training of Adult Professionals (ATP) and the Problem Solving Approach (PSA) are very successful.
5. Training has a limited effect. Training alone is not enough to effect large changes to a system. The whole operations team must be involved. This means close supervision from management and strong monitoring of the implementation progress, with feedback to the place of work.
6. Operational units can be trained successfully using the TAP methods. Groups can be formed of operating units.

DISCUSSION.

Training Strategy

The question was raised whether it would have been more successful changing the maintenance management system by starting with a smaller pilot project focusing on a few pilot districts instead of immediately implementing training country wide.

It was admitted that this would have been a safer approach and that such an approach would also have enabled the trainees to plan the maintenance requirements of their respective district in their own environment. The training management initially expect that the district engineers would understand the Interim Maintenance Manual, which they did, and apply it which they did not. It was considered that this was due principally to two factors, first some engineers lacked the skill to implement the system and second, most importantly, very few engineers had the right attitude to put it into practice. The training management wrongly did not involve district engineers in decision making. The subsequent refresher course served to formulate their own realistic plans and overcome these problems.

In general, it is easier to introduce a new system than to change an existing approach. With an operational system already in place, the maintenance management was more reluctant to changes.

Status of the Maintenance Management System

The final version of the Maintenance Manual will be available in June 1992. The training so far has been based on the Interim Maintenance Manual of 1988. The final report on the Maintenance Study 2 recommends a number of additional modifications. The findings of this study will be incorporated in the final manual. The training programme will be modified accordingly.

Major Changes

The main reason for modifying the maintenance system was to improve the effectiveness of the lengthmen through improved management. It has been suggested that the current productivities are only

55% of what is theoretically achieved. The main change in the new maintenance manual is the allocation of the specific tasks to the headmen and lengthmen by the overseer. Previously the overseer's task was to a great extent limited to checking the attendance of the lengthmen. In the new system the required work is quantified and prioritised before clearly specified tasks are set for a two week period. To enable this clear and formalised instructions have been developed.

Maintenance Contractors

Expect for regravelling works no maintenance contracting is envisaged. Due to the low number of contractors in the rural areas it would be difficult to introduce a system of competitive bidding at the stage. Before this can be regarded as a viable alternative a fully developed system must be established. In central province of Kenya small scale contractoes are engaged on gravelling works through a SIDA financed pilot project.

At the moment it is felt that there is no need to turn to contracting because force account by lengthmen works well in Kenya and that therefore there is no reason for an immediate change.

Other Labour-based Programmes

If the proposed maintenance management system proves successful and the effectiveness of the labour-based maintenance system is increased, this experience should be shared with other labour-based programmes in the region. The Kenyan maintenance manuals are not international manuals, but could be used as a start when developing or improving a mainenance management system. The manual would not have to be adjusted to country specific condition.

Future Research

It was emphasised that maintenance experiments on technical aspects will have little or low effect on the peformance of the maintenace system. Efforts should be concetrated on managerial and motivation aspects. As an example, it was felt that further research is needed to improve the monitoring of maintenance works.

There are still questions of maintenance standards to be resolved. One example is the relationship between the periodicity of regravelling works and routine maintenance. When regravelling is done more frequently, to what extent will the routine maintenance requirements be reduced? Some roadswith very little traffic are not gravelled at all. What are the concequences in terms of routine maintenance? To what extent will these roads require an increased routine maintenance input?

III. APPROPRIATE EQUIPMENT FOR MAINTENACE

A PROGRAMME FOR LABOUR AND TRACTOR BASED MAINTENANCE OF THE CLASSIFIED ROAD NETWORK MINISTRY OF PUBLIC WORKS, GOVERNMENT OF KENYA

Presented by A. Beusch of Intech Associates

Prepared by: Intech Associates (extract from project paper, by R. C. Petts and A. Beusch)

We kindly wish to acknowledge the use of all background information for this paper from the Ministry of Public Works of the government of Kenya.

1. INTRODUCTION

Since 1974 the Kenya government has constructed 8000 km of Rural Access Roads to all weather gravel standard using labour-based methods. A further 4500 km of classified D and E roads are also being improved using similar techniques. These roads are being maintained by labour-based method using the lengthmen system of routine maintenance with periodic regraveling support using tractorbased units. A significant portion of the 62,000 km classified road network is therefore now being maintained by labour-based methods.

Intech Associates were appointed in August 1990 to review the current system of mainenance on the remainder of the Kenya classifiedroad network under funding assistance arrangements by the Swiss Directorate of Development Cooperation and Humanitarian Aid (SDC). The current heavy equipment based maintenance operation are severly hampered by a wide range of factors. A comprehensive analysis was caried out using a logical framework approach. Proposals were developed for improving road maintenance peformance with particular emphasis on the appropriate use of labour and tractor based technology and increased use of the private sector. The consultant's findings were presented at a planning workshop in November 1990 where analysis and proposals were refined and adorsed. The proposals are tested and developed in an 18 month Pilot Phase. The pilot project will also develop systems and training requirements for wide implementtion on the new technologies.

The work completed to date forms the initial part of the Ministry of Public Works phase programme with the stated objective of :

MAINTENANCE OF THE CLASSIFIED ROAD NETWORK TO AN ECONOMIC LEVEL OF SERVICE ABILITY USING LOCAL RESOURCES AND LABOUR-BASED METHODS WHEREVER THESE ARE COST-EFFECTIVE.

2. BACKGROUND

2.1. The Road Maintenance Problem

2.1.1 The current Situation

KENYA'S ROAD NETWORK

Kenya's 61,688 km of classified roads (7,689 km bitumen surfaced) are concetrated mainly in the more agriculturally productive areas. A recent visual survey of the surfaced roads indicated that 32% are in good condition, 39% are in fair condition requiring some form of resurfacing or strengthening, and 28% are in critical condition. The ltter exhibit extensive amount of failure, so that repairs amounting perhaps to complete reconstaction are necessary. Rehabilitation of the paved network is estimated to cost Kenya Pound 650 million, at present prices, and extra vehicle operating cost on these deteriorated roads amount to about Kenya Pound 230 millionper year.

The amount of gravelling carried out on the 25,266 km of gravel roads (113 km in 1989) recently suggests that many have now reverted to earth road standards. However, traffic level on the majority of gravel roads are very low, and generally gravelling could not be justified, especially in view of shortage of materials.

The unsatisfactory network condition has been brought about by insufficient road maintenance over na extended period of time. Basic routine maintenance of the whole network is inadequate due to a range of

funding, equipment and manpower constraints.

2.1.2 Maintenance Needs

In order to maintain classified roads to reasonable standards, the annual expenditure should be about Kenya Pound 66.25 million (Mid 1990 prices), made up of Kenya Pound 26.25 million for routine maintenance (recurrent) and Kenya Pound 40 million for periodic maintenance. This level of expenditure is estimated as sufficient to keep in good condition those where traffic warrants full maintenance, but others where there is little traffic would receive only minimal maintenance. Full maintenance of roads is estimated to cost about Kenya Pounds 140 million per year, and could probably not be economically justified. However, the estimates assume (1) that roads have been rehabilitated where necessary to a maintainable condition, and (11) that maintenance is efficiently carried out.

FY90/91 Budget allocations for roads, including new construction and improvements, are about Kenya Pounds 66.3 million from all sources. Hence to achieve reasonable levels of maintenance, the entire present roads budget, both recurrent and development, would be necessary. Planned expenditures in the recurrent budget, Haeds 384 and 385, for routine and periodic maintenance in FY1990/91 amount to only Kenya Pounds 8.3 million to cover field operating costs; personal emoluments and equipment being paid from other votes. This figure is about one third of the amount necessary to pay for field operating costs for correct levels of routine maintenance alone.

2.1.3 Maintenance Resources

The existing vehicle and equipment fleet is generally aged and availability rates are assessed to be low (< 20% for heavy plant). The existing maintenance system relies on transport to take the labour force to the work site each day. Low transport availability severely restricts the amount of work that the labour can achieve. Problems of inappropriate staffing, inadequate training, and lack of funds for operating expenses further constrain road maintenance performance. Subordinate staff make up 60% of the 15,000 permanent workforce of the Roads Department, the majority of which are assigned to road maintenance activities. The underdeveloped management systems and poor motivation result in very low work output from this workforce (see Annex 1a).

2.2 Labour-based Experience in Kenya

The Rural Access Road Programme, and latterly the Minor Roads Programme, has demonstrated that the labour-based approach to improvement and maintenance of roads is a viable and cheaper alternative to the existing equipment-based system used on classified roads. The lengthmen maintenance system reduces foreign exchange requirements and creates significant useful rural employment. During the 1989/90 financial year, 8842 km of roads were under routine maintenance, creating employment for 6310 part time lengthmen (see Annex 1b)

In addition, 435 km of roads were regavelled under periodic maintenance during the same period with the employment of 4190 casuals. Hence over the current five year plan period of the programme, it would have created employment approximately to:

31,550 man years of lengthment and
20,950 casual labourers employed under periodic maintenance.

The average cost of maintaining a kilometre of road by lengthmen is about Kenya Pound 200 per year

excluding the supervision equipment: motor cycles and Land Rovers for the supervisory staff.

For periodic maintenance, mainly regravelling, the cost is approximately Kenya Pound 6,750 per kilometre. The only equipment items used are 50 hp (37 kW) agricultural tractors towing gravel haulage trailers.

2.3 Government Policy Framework

With an estimated two million extra workers coming into the labour market during the current 1989/93 Development Plan, there is an urgent need to create extra employment opportunities, especially in rural areas. The plan promotes labour-based technologies in road construction and maintenance, and stresses the need to maintain the existing road network rather than constructing new roads.

Government has always been, and remains, the largest employer of labour in Kenya. The current Development Plan recognises that there is serious overstaffing in the government, so that about two thirds of the recurrent budget is spent on wages, leaving insufficient funds to carry out work programme. The plan envisages a slower growth of public sector employment, and more efficient use of labour employment. The cost-efficient use of labour is seen as a means of conserve foreign exchange where conditions are suitable.

Within the roads subsector, government has agreed that priority shall be given to routine maintenance, followed by resealing, regravelling, rehabilitation and strengthening of roads. Upgrading from gravel or earth to bitumen standards is given a lower priority. These policy decisions of government, taken with the principles of the 1989-93 Development Plan, are soundly conceived to conserve existing resources as much as possible, to minimise the use of scarce foreign exchange, and to make the minimum use of readily available manpower consistent with satisfactory results and lowest costs.

2.4 Phase 1 Study and Phase 11 Planning Workshop

A major project workshop was held in Nairobi from 26th through 28th November 1990 to analyse problems with the country's maintenance of classified roads and to develop appropriate solution for the next decade. The workshop was attended to presentative staff of the Ministry of Public Works representative of the ILO, the World Bank and several national aid organisations.

A major information input a group consultants (Intech Associates) had conducted related investigations, surveys and interviews and produced a four volume report on their investigations (Phase I). Intech organised and facilitated the workshop in order to present their findings and conclusions to technical, managerial and political specialists, who could discuss, correct and refine them.

The report submitted by the consultants included a tentative problem analysis ("PROBLEM TREE") relating to inadequate road maintenance on classified roads in Kenya, together with analyses of a number of options that might be adopted to improve performance in the future. These were considered by the workshop and, after revisions and refinement of the problem tree, all but one of the options were adopted. The options were ranked as either essential or very desirable in order to improve road maintenance. The only proposal rejected was for the formation of a parastatal body to undertake road maintenance. It was not adopted as participants felt that the alternative of developing private sector contract capabilities would be better and subject to less risk.

The workshop participants went on to consider necessary follow-up actions. As some recommended

options involve uncertainties, it was agreed that a pilot project should be set up.

The following section summarises the outputs and recommendations of the Phase II workshop.

3. PHASE II WORKSHOP OUTPUTS

3.1 Problem Analysis

Analysis of the present and expected future situation of road maintenance were conducted on the basis of field visits, document analysis and interviews with road maintenance staff on all levels. The findings revealed a vast array of problems, which make maintenance of the network difficult and ineffective at present. The essence of the analysis was compiled and arranged as a problem tree, highlighting the relationship between causes and effects. The problem tree was used as a powerful diagnostic tool to find and prioritise areas for remedial actions.

The problem analysis focused on "Insufficient Road Maintenance" as the core problem and analysed in detail the causes. Three main areas of concern were identified:

FUNDING

EQUIPMENT and the

EXECUTION OF THE WORK

The provisional problem tree was presented at the workshop and after detailed discussion in working groups the assessment was refined and finalised.

PROBLEM ANALYSIS

3.2 Outline Strategy

Within the policy guidelines discussed in Section 2.3 a strategy was developed for "attacking the funding deficit" in the context of the unpaved classified road network. The strategy was agreed at the Government of Kenya and donors annual review meeting for the Minor Roads Programme held between 19 and 22 November 1990.

The Phase II workshop further developed this strategy in the context of the maintenance of the entire classified road network.

After analysis of current problems the Phase II workshop addressed the scope within which maintenance of the network could be improved on a long term and sustained basis. It became clear that at the end of a complicated and careful decision making process, a stable maintenance system with complete network coverage is desirable.

This will require high-level and far reaching decisions which need to be taken in the context of the formulation of overall road maintenance policies. Kenya is already involved in the "Road Maintenance Initiative (RMI)", which emerged from a joint methodological approach of a number of multilateral and bilateral agencies.

To integrate labour and tractor based methods into such an approach will require well supported evidence on the advantages, feasibility and cost-effectiveness.

The workshop participants felt that they could offer at present (mainly based on MRP experience) certain very convincing recommendations for decision makers. However, more information, better justification and more detailed solutions will be needed to support the political decision making process.

It was understood, that the various efforts should continuously generate services to policy makers and planners, which are information, justification, "marketing", donor involvement, and the creation of commitment at all levels of the institutions involved.

Such services have been planned and the project will have to guarantee these services . The impact on political decision making can not be controlled, but here are strong indications of political change towards labour and tractor based technology and optimum use of Kenyan resources.

SESSION 4: CONTRACTORS

Summary

In Ghana the Department of Feeder Roads with the technical assistance of the ILO has commenced on a programme financed by the World Bank and UNDP to train small scale contractors to rehabilitate the feeder road network using light equipment and labour-based methods. Since the start in 1986, 41 contractors have been trained and approximately 650 km of roads have been rehabilitated at an average cost of 10 000 US\$/km and an average input of 2650 workdays/km.

Based on the experience in Ghana it is clear that a successful involvement of the private sector has more to do with institutional issues such as appropriate tender regulations and documents, payment procedures and credit facilities rather than the labour-based technology.

Osei-Bonsu and Peter Bentall reviews the Ghana programme and elaborates on the key issues which has ensured a successful programme.

- I. [The Use of Private Contractors](#) - by Kwaku Dua Osei-Bonsu.
- II. [Aspects and Background for Labour-based Contracting](#) - by Peter Bentall

I. LABOUR-BASED ROADS REHABILITATION THE USE OF PRIVATE CONTRACTORS

**Presented by Kwaku Dua Osei-Bonsu National Coordinator Labour-based Works
Department of Feeder Roads, Accra, Ghana.**

This paper reviews the use of the private sector in feeder roads rehabilitation by labour-based technology in Ghana. It also highlights on the organisational, administrative and managerial procedures adopted during the implementation of the World Bank/ UNDP/ ILO/ Ghana Government pilot project and the current practice.

1.0 Introduction

Ghana by tradition is known to have a developed local contracting capacity both in the Roads and Building sectors. The current classification system by the Ministry of Roads and Highways, the Road and Bridges Contractors indicates that there are over 131 contractors who are capable of executing roadworks to the tone of \$0.4 million, whilst 256 have been identified for the construction of Drianage Structures including Bridges (Appendix 1).

The country's economy in the early 80's deteriorated to the extent that inflationary rates were extremely high and the lack of foreign exchange resources to import spare parts for the broken down heavy machines, resulted in most of the roads being neglected (3). It was against this background that the Departemnt of Feeder Roads (DFR), which has the responsibility of providing continuous access to villages, decided to adopt the labour-based approach with emphasis on the use of private sector.

2.0 Project Objectives

The development objectives of the 3 year pilot which was started in late 1986 was to build up the capacity of small locally based private contractors to efficiently apply cost effective labour-based techniques in road rehabilitatin and maintenance. It also aimed at developing the capacity of DFR in the

planning and implementation of feeder roads rehabilitation and maintenance. The objective was to be achieved by the introduction of improved engineering, organisational, administrative and managerial techniques as well as modifying the Institutional framework within which these techniques had to be applied.

3.0 Contractor Selection

DFR focused its attention on small scale contractors which in this context meant that the owner of the firm performed the duties of both the Managing Director as well as being the Site Manager. This therefore implied a simple organisational structure with very little overheads.

DFR in conjunction with ILO officials held a series of seminars to educate both the public and the contractors in the efficient use of the labour-based technology for road rehabilitation and maintenance. The seminars helped to erase the scepticism initially expressed by many on the cost effectiveness of the technology.

Questionnaire forms which requested information on the firms' experience, manpower, financial, plant and equipment resources and the ability of the firm to sponsor four of its staff for training were given to interested firms to fill.

The project document stipulated the selection of 8 contractors for training of which the best 4 amongst them were to be equipped. This was due to the fact that only 4 sets of standard equipment had been procured for training and eventual possession of the 4 selected contractors under the pilot project.

4.0 Contractor Development

Having identified some of the key problems confronting the construction industry in Ghana to be the local contractors' lack of management capabilities in the efficient use of financial, equipment, material and personnel resources and the cumbersome procedures in the processing and honouring of payment certificates, DFR with the assistance of the ILO technical team addressed the issues pertaining to the contractors by drawing up a training package which consisted of three main phases namely (a) Class Room Training, (b) Field Training Stage and (c) Trial Contract Phase. This package was designed to ensure that each progressing phase experienced more difficult and complex tasks.

4.1 Class Room Training

This phase involved seven weeks of intensive training using ILO training manuals. Topics treated included mathematics related to roadworks, the basic principles of road construction and maintenance, equipment and man management as well as the financial management of firms which was covered by lecturers from a local bank. Trainees for this phase comprised of foremen and supervisors designated by the 8 contractors and staff from DFR.

4.2 Field Training Stage

The objectives of this phase was to help the trainees develop and acquire the practical skills in the effective use of labour-based techniques.

The 16 week programme involved the construction of a 10 km model/demonstration road under the DFR Project Management Team (PMT). The trainees were made to work for a short period as workers in various activities before being made gang leaders and finally as foremen supervising each of the many

activities as weekly rotational basis.

The trainees participated in weekly site management and performance evaluation meetings which were considered part of the training. Both the PMT and the trainees had the opportunity at these meetings to exchange ideas and clarifications were given on issues which were not fully grasped during the classroom training. At the end of this phase, the World Bank agreed to buy additional sets of equipment as a result of the proven capabilities of all the contractors.

4.3 Trial Contract Phase

The first and second stages of the contractor development phase actually developed the individual's capacity to effectively apply the labour-based techniques. Hence, the objective of the Trial Contract Phase aimed at assisting the contractor to develop the capacity of the firm to effectively manage a labour-based road construction of the 4 contractors was awarded 5 km of roads to rehabilitate within a period of 4 months inclusive of mobilization. The contractor was fully responsible for the progress and quality of works whilst the Project Office provided some services which allowed the contractor to concentrate on managing works at the site.

Prior to the start of the roadworks, each contractor with the assistance of the PMT prepared a work programme in the form of a Time Location Chart which served as a control tool in the execution of works.

4.3.1 Contract Conditions

Trial contracts were considered to be non-standard in the sense that special conditions had been designed to achieve objectives under non-standard conditions. To facilitate the smooth administration of the trial contracts, DFR incorporated special conditions and additional clauses which were read in conjunction with the Articles of Agreement and Conditions of Contract (Form B) ICE.

Some of the special conditions adopted were as follows:

- The engineer's authority under the contract was delegated to the supervising officer namely the Project Engineer for the administration and payment of contracts. However, this did not include the granting of approval for variation orders and extension of time.
- It was mandatory for the contractor to employ between 100 - 150 skilled, semi-skilled and unskilled workers on daily task work basis to ensure that the 5 km stretch was completed within the contract period of 4 months. The contractor was expected to keep records of labour and also to agree on task level and payment system with the supervisory officer.
- The contractor was to submit labour returns on the 26th of each month for vetting by the supervisory officer. 15 % was added to the amount to cater for the contractors overheads and a cheque was issued by the project office to enable the contractor effect payment unconditionally to the worker on the 3rd working day after the close of the month.
- The project office made available to contractors basic materials such as handtools, cement and fuel upon request. Departmental charges were then added and debited to the contractor.
- At the end of each month, works executed by the contractor were measured and the DFR established unit rates applied. Deductions in respect of labour advance, materials supplied and cost of equipment were effected from the Interim Payment Certificate (IPC) and the balance paid to the contractors after the IPC's had been endorsed by the District and Regional Administration.

- Copies of IPC were forwarded to DFR Head Office for post checking and any amendment by the Engineer was made the following month.
- Final certificate payment had to be made at DFR Head Office.
- The project also provided mechanical back-up services and the training of operators since the contractors had neither of these.
- Weekly evaluation sessions were held by the PMT with the contractors to discuss the progress of each contractor, problems encountered and the planned programme for the coming week. These sessions were considered as very important training tools since solutions to problems were jointly sought by all.

4.3.2 Unit Rates

Unit rates applied on the trial contract were derived from work studies carried out on the model/demonstration road. The cost of equipment input was computed using the amount payable by DFR to the Bank for Housing and Construction for renting the standard set of equipment (2).

4.3.3 Contract Supervision

Although the contractor was solely responsible for the day to day management of the site, the PMT attached a trained DFR foreman to each of the firms whilst a resident engineer was responsible for monitoring the overall management performance of the 4 contractors.

5.0 Standard Contractors

Following the success at the trial contract phase, the contractor was awarded 25 km of road to be improved for a year. The administration of contract in this phase followed the normal trend for road projects.

Logistic support such as the supply of cement and fuel which were provided under the trial contract phase ceased. Funds were only made available for the payment of labourers for the first four months of the contract and any further labour advance was at the discretion of the supervising officer since overdraft facilities had been granted to the contractors by the bank for the purchase of materials and also to pay their workers whenever there was a delay in releasing money by the project office.

5.1 Contract Supervision

A DFR trained foreman was attached to each Contractor's site and six of such sites were placed under the supervision of the Project Engineer. Thus an engineer, a quantity surveyor and four foremen were all the staff required to manage a project site comprising four trained contractors.

5.2 Man Management

Before the advent of this pilot project, DFR operated the direct labour system i.e. workers were paid a fixed sum of money for 8 hours attendance with no account taken of output. Absenteeism was high, moral low, and supervision was almost absent and therefore output was low. It was the culmination of these factors which led to the adoption of contractors instead of using direct labour operations.

In spite of DFR being a civil service organisation, the project design had an inbuilt flexibility which enabled the PMT to experiment, test and develop cost effective systems. One of such systems developed

was a payment scheme whose structure was based on fixing a daily wage comparable to the market rate and paying additional incentives in the form of extra mandays. Thus, if a worker was continuously present for the 6 working days of the week and accomplished his tasks, he was paid 8 days wages. Similarly, if he was present continuously for 4 weeks he earned an extra 6 days wages. Thus a worker who accomplished his task on all working days of the month could attain a maximum bonus of 45 % of the monthly wage. This measure was adopted to ensure consistency of the labour force to achieve set targets on the demonstration road. The system which was found to be workable was adopted by the contractors at their sites.

6.0 Current Practice

In view of the competitive bidding recently introduced by the Ministry of Roads and Highways (MRH) and also the fact that over 200 classified and unclassified contractors have expressed their interest to participate in the programme, DFR has modified the selection criteria for contractors as follows:

- (i) The contractor considers labour feeder roads improvement to be his main business for at least the next three years (1).
- (ii) The contractor himself intends to manage the road works at the site.
- (iii) The contractor agrees to sponsor four of his staff whose minimum qualification should be GCE"O" level or a technical certificate for the training. Any contractor who agrees to participate fully in the training programme would be selected in the first instance.
- (iv) The contractor is expected to have resources to sustain the four staff during the training programme and in addition, to have a working capital to prefinance the company's operation until payment is received for the works executed.
- (v) The contractor meets the banks requirements in respect of the loan for equipment.

6.1 The duration of the classroom and the field training stage has now been reduced from 23 weeks to 20 weeks in view of the educational background of the new trainees.

The major factor which formed the framework for the administration of the trial contracts under the pilot project phase has been modified following the spread of the technology to the various regions and the fact that the equipment is now leased directly to the contractor by the bank. Payment for work done is now effected from the head office as cheques are issued in the joint names of the contractor and the bank. This arrangement is to enable the bank to make monthly deductions in respect of the leased equipment to the contractors.

Although the initial system has been modified, it is still seen as the 'ideal' way of administering projects and should be adopted, if possible, when new projects are being implemented.

6.2 Contractors on the standard contracts now do receive an Advanced Mobilisation Loan which is the equivalent of 15 % of the contract value less contingencies and general items. Although funds are made available up front, yet 80 % of the contractors interviewed expressed the desire to have the former system of advancing money for the payment of workers restored. This has been due to the fact that the loan does not meet their obligations, since the cost of labour is about 40 % of the total input.

In spite of the contractors' preference for the monthly labour payment, it needs to be mentioned that this

system also places a lot of strain on the supervising officer, since it becomes his responsibility to ensure that adequate funds are transferred in this respect.

6.3 Competitive Bidding under standard Contracts 19 of the 24 trained and equipped contractors who have gone through the third phase of the programme have undertaken the tendering of project through the competitive bidding procedures. The analyses of the bids show that the bid prices range from 6 % - 15 % above the engineer's estimate. It must be admitted that the bidding procedure was not as keenly competitive as one would have expected, since 19 projects were advertised to be bid by the 19 contractors (each tenderer was requested to bid for a minimum of two lots with the understanding that only one lot will be awarded).

For the administration of contract under the competitive bidding, DFR uses FIDIC (1977) conditions whilst CESMM (2nd edition) is used for the preparation of Bill of Quantities.

7.0 ACHIEVEMENTS

TRAINING: A total of 374 engineers, supervisors and foremen have been trained in the application of labour-based technology to feeder roads construction, rehabilitation and maintenance. The break down of the personnel trained is as follows:

Contractors Supervisors - 183 from 41 firms
DFR Engineers - 55
DFR Foremen - 136

OUTPUTS: Since the inception of the pilot project, 646 km of feeder roads have been rehabilitated to year round accessibility standards by the 19 equipped contractors and some 1593 box culverts of the project design have been constructed. The average production achieved on the standard contract is 1.67 km/month per contractor instead of the project target of 2.2 km/month. The shortfalls in production on both trial and standard contracts have been due to the excessive downtime in the performance of the pedestrian vibrating rollers.

CONCLUSION: The success of the programme has largely been attributed to the effectiveness of the training during the contractor development stage, supervision and special assistance given to the contractors by DFR. The cost effectiveness of this technology has been demonstrated by the 19 trained and equipped contractors through the rehabilitation of over 650 km of badly deteriorated roads to good quality and durable standards. It is envisaged that by the end of 1992, 48 trained contractors would have been equipped with the assistance of DANIDA and USAID to rehabilitate over 900 km of feeder roads annually.

References

1. S. Matusiak Discussion Paper on the Prequalification of Small Scale Contractors, February 1990.
2. K.D. Osei-Bonsu Establishment of Unit Rates for Contractors' Trial section. Paper presented to the Ghana Institution of Engineers, October 1987.
3. Project Document Ghana Govt.\UNDP\ILO Document, September 1985.

Further Reading

P.H. Bentall Final Report. Ghana Feeder Roads Rehabilitation and Maintenance CTP 116.

SESSION 5: COMPACTION

SUMMARY

Compaction of 95 % and more of maximum dry density which is normally specified for fill, sub-base is hard to achieve without equipment. The question of appropriate compaction methods remains to a certain extent unresolved.

Since standard rollers are too costly and their productivity too high to be compatible with a labour-based construction unit, pedestrian rollers have been recommended.

How these pedestrian rollers perform is reviewed by Htun Hlaing.

Whether existing compaction specifications are appropriate for low traffic earth and gravel roads is discussed. Andreas Beusch explains how in the Kenyan Rural Access Road Programme roads were constructed to satisfactory standards without compaction equipment only using natural and traffic compaction.

Dr. Kyulule presents a proposal for a research programme on compaction for labour-based road projects.

I. Lightweight Compaction Equipment

Pros and Cons of the Pedestrian Vibratory Rollers - By Htun Hlaing

II. Road Performance without Compaction

The Kenyan Experience - By Andreas Beusch

III. Technology Development Programme (TDP)

Labour-based Compaction Methods for Rural Roads - By A.L. Kyulule

I. LIGHTWEIGHT COMPACTION EQUIPMENT

Presented by Htun Hlaing, ILO Training Adviser labour Construction Unit, Ministry of Works, Lesotho

Pedestrian vibrating rollers can be used for compaction in labour-based road works. In Ghana rollers are used for compaction in activities such as cut-to-formation, camber formation and gravelling. In formation activity the fill materials were compacted in layers not greater than 150 mm at a time. The water content in the loose material were checked and if necessary water was applied before compaction. After formation, camber was formed using materials excavated from the side ditches and slopes. After compaction a 7 % camber was to be achieved. The compaction for camber formation and gravelling was done half-road-width at a time. This enables the traffic to move on the other half width of road. Compaction was done from the outer side of the road carriage way towards the centre of the road. The roller tracks were to overlap each other about 100 mm side to side. As a rule of thumb, any point along the carriage way should be compacted without vibrating for one pass and then with vibration for another five passes before the final pass which was done without vibrating. The moisture content before compacting should be checked and if necessary watered. Along the edge of the road compaction was done manually by hand rammers. Compaction tests were carried out and 98 % density was achieved after compacting using the above method (The Ghana standard requirement for compaction is 89 %).

In The Ghana Labour-based Feeder Road Project, two types of vibratory rollers were used for compaction. First the Benford 2-60B rollers were used. After two years of use on the site, these rollers started to have frequent breakdowns which seriously effected the progress of work. It was found to be no more economical to keep on using these rollers after two years. Due to the frequency of the breakdowns on this type of rollers it was decided to purchase a different type of rollers. As a trial Bomag BW 65 S rollers were purchased. The Bogmag BW 65 S rollers were giving problems even before they were one year old such as malfunction of the vibrating system and frequent breakage of the vee belts. Therefore, through this experience it was obvious that these types of rollers were not meant for continuous running throughout the day. Towing trailers were used for moving the rollers from one place to another but the towing trailers were low tooo for some rough terrains. The above two models of rollers can also be transported by Land Rover Pick-ups.

Finally the Bomag BW 90 S which was also used in Lesotho was accepted in Ghana as the suitable model.

The rollers from Lesotho do not have a common specific part that breakdown. Therefore it is difficult to say which part is the common breakdown. Most breakdowns are caused by the operator's carelessness.

One important point for the supervisor is to make sure that the roller operator uses the vibration system of the roller for four passes after he has compacted without using the vibration system. The roller operators do not like to use the vibration system because the handle of the rollers get vibrated strongly effecting ease of handling the handle. This can result in roads not being compacted well.

Another common carelessness is that the operators put the lubricants such as engines oil into where hydraulic fluid is to be used and vice-versa.

In Lesotho the roller operators sometimes become careless that during moving/driving of the roller from one place to the other, they still keep the vibration system running causing the parts in the roller to wear out faster. Sometimes the operator will be running the equipment without checking the engine oil level.

COMPARISON OF PERFORMANCE ON PEDESTRIAN VIBRATORY ROLLERS

DESCRIPTION	ROLLER TYPE		
MAKE	BENFORD (GHANA)	BOMAG (GHANA)	BOMAG (GHANA)
MODEL	2-60B	BW 65 S	BW 90 S
WEIGHT	880 KG	600 KG	1240 KG
CENTRIFUGAL FORCE	2150 KG	2.4 T	3.1 T
DRIVING SPEED	2.4 KM/H	3.2 KM/H	2.6 KM/H
ROLLER WIDTH	610 MM	650 MM	900 KM/H
ENGINE POWER	5.9 KW 7.92 HP	3.7 KW 7 HP	8.8 KW 12HP

<p>COMMON BREAKDOWN</p>	<p>OVERHEATING, CABLE BREAKAGE, OIL LEAK FROM TOP COVER GASKET AND CAMSHAFT SEAL</p>	<p>BREAK OF VEE BELTS, MALFUNCTION OF VIBRATING SYSTEM</p>	<p>CYLINDER ROLLER BEARING, CENTRIFUGAL CLUTCH AND PULLEY, COUPLING SHAFT, INJECTOR PUMPS, ECENTRIC DRIVE SHAFTS AND WIGHTS, SPUR WHEEL, PISTON RINGS, SILENCER, OIL BATH AIR FILTERS</p>
<p>PARTS MOST NEEDED</p>	<p>FUEL FILTERS, GASKETS, SEALS, CABLES, MOUNTING RUBBERS</p>	<p>FUEL FILTERS, VEE BELTS, CABLES</p>	<p>PISTON RINGS, OIL BATH AIR FILTERS, MOUNTING RUBBERS</p>
<p>ADJUSTMENT DONE TO ORIGINAL ROLLER</p>	<p>REMOVAL OF FUEL FILTERS FROM INSIDE FUEL TANKS AND FIXED OUTSIDE. CHANGED THE DIRECTION OF THE INLET AND EXHAUST PIPES WHICH WERE TOO CLOSE AND FACING EACH OTHER.</p>	<p>NIL.</p>	<p>REPLACEMENT BY ELBOW TYPE OF EXHAUST PIPE FOR THE SILENCER BECAUSE THE ORIGINAL FALLS OFF EASILY DUE TO WEAK MOUNTINGS.</p>

ADVANTAGES AND DISADVANTAGES	EASILY TOWABLE BY 4X4 WHEEL DRIVE. FREQUENT BREAKDOWN AFTER TWO YEARS OF USE	EASILY TOWABLE BY 4X4 WHEEL DRIVE. TOO LIGHT TO BE USED ON LABOUR-BASED ROADS.	DIFFICULT TO TOW UP STEEP HILLS UNLESS LOADED ON LOW BED TRUCKS. SUITABLE FOR COMPACTING ROCKY TYPES OF SOIL
SUGGESTIONS AND COMMENTS	IT IS DESIGNED FOR LIGHT DUTY AND INTERMITTENT USE, A HIGHER CAPACITY ROLLER WOULD BE PREFERABLE.	IT IS DESIGNED FOR LIGHT DUTY AND INTERMITTENT USE, A HIGHER CAPACITY ROLLER WOULD BE PREFERABLE	ALTHOUGH IT IS HEAVIER TO TRANSPORT, IT IS SUITABLE FOR TYPE OF GRAVEL AVAILABLE IN LESOTHO.

PROS AND CONS OF THE PEDESTRIAN VIBRATORY ROLLERS

ADVANTAGES	DISADVANTAGES
- Intensity of rainfall	
- Traffic Volume	
- Composition of traffic	
- Social and political reasons	
- Cost of maintenance	
	- Breakdown of rollers
	- Availability of skilled mechanics
	- Availability of spare parts

COMPACTION TEST RESULTS

LABOUR-BASED ROADS IN GHANA

NUMBER OF PASSES	DENSITY IN %	
	WITH VIBRATION	WITHOUT VIBRATION

2	82	70
4	91	73
6	93	79
8	100	

Where: moisture content is 12 % to 14 % tests conducted using sand replacement test, Ghana required standard for compaction is 98 % and gravels are well graded granular materials.

COMPACTION TEST RESULTS FOR LABOUR-BASED GRAVEL ROADS IN GHANA

II. ROAD PERFORMANCE WITHOUT COMPACTION THE KENYAN EXPERIENCE

Presented by Andreas Beusch, Intech Beusch + Co.

Compaction in the Kenyan Rural Access Roads Programme

As a programme policy no formal compaction - equipment was used in the construction of Rural Access Roads (7230 km). Gravelling was done 6 months or more after completion of construction. The natural setting of the road during at least one rainy season and compaction by traffic was considered sufficient for the type of roads under the project:

RAR's are no through roads, maximal length = 10 km

Design speed = 30 km/h

Max. 50 VPD

Main purpose is to provide all-year access

Certain roughness caused by lack of controlled compaction is acceptable

Special attention has to be given to continuous reshaping of the carriageway during the period between construction and gravelling. Routine maintenance length persons are able to cope with this work (section length about 1.5 km).

Sufficient material is required to form a camber crossfall of up to 10 % during construction. This allows the camber to settle to a final crossfall of approximately 5 %.

Gravelling is done by dumping and spreading immediately by working away from the quarry. In this way the tractors and trailers will drive over the newly gravelled road by driving on the edge of the carriageway moving towards the centre with each trip.

Compaction in the Kenyan Minor Roads Programme

The Minor Roads Programme improves classified roads of a higher grade (usually D or E class roads) with a wider carriageway and higher traffic volumes. Apart from providing all-year access, road user costs become a factor of higher importance than in the RARP. A form of simple compaction was therefore considered as wishful for the programme. Since compaction with equipment such as tractor

towed dead weight rollers, self propelled vibrating rollers, etc., was considered less suitable for a labour-based programme, a steel roller which can be pulled by labourers or animals was developed.

Field trials with this roller have shown the following results:

The roller consists of a hollow steel drum which can be filled with water for operation and emptied for easier transport from site to site. The weight for the empty roller is 500 kg and when filled with water 1200 kg. The width of the drum is 90 cm.

Compaction is done without watering. Although the moisture content of the soils compacted is usually less than the optimum moisture content, 8 - 12 passes of the roller can achieve a density of 95 % of the Maximum Dry Density.

In dry areas or on stony or sandy soils the roller is less effective.

The roller can be towed by labourers or donkeys or oxen.

0 - 5 % gradient	8 - 12 labourers 4 - 6 donkeys 2 oxen
up to 1 % gradient	18 labourers

(On gradients of more than 5 % animals are unable to restrain the roller while going downhill).

NOTE: All dimensions are in millimeters.

DETAILS OF PRINCIPAL COMPONENTS

1. Hot rolled channel 2No. 100 x 50 x 4 mm thick; Length 3060 mm.
2. Formed steel-drum of 1000 mm diameter. 900 mm width, surface steel plate 10 mm side steel plate 12 mm with 1¼ diameter water-fill-drain plug - 2No.
3. Handle bars - 2No. 60 mm diameter mild steel pipe; length 2520 mm.
Handle bars - 4No. 60 mm diameter mild steel pipe; length 700 mm.
4. Scraper blades - 2No. 962 mm x 100 mm x 4 mm thick, adjustable.
5. Hot rolled channels - 2No. 100 x 50 x 4 mm thick; length 1170 mm.
6. Scraper handles - 4No. 10 mm diameter round bars 150 mm x 42 mm.
7. Wing, bolts & nuts - 8No. 10 mm diameter; length 28 mm (B.S.C)
8. Stub axles - 2No. axle steel, diameter 55 mm, length 195 mm.
9. Bearing base plates - 2No. mild steel 280 x 82 x 10 mm.
10. Bearing housing, mild steel round bar 125 mm diameter, 50 mm diameter, 50 mm long, flattened on two sides - 2No.
11. Bronze bush, inside diameter 56 mm, outside diameter 69 mm, thickness 6.5 mm, length 50 mm & grease grooves inside.
12. Grease nipples, 2No. 10 mm diameter with grease hole 5 mm diameter.

13. Mild steel plates - 2No. 280 x 82 x 10 mm thick.
14. Bolts and nuts - 4No. length 45 mm, diameter 12 mm completed with washers.
15. Mild steel rings - 2No. diameter 70 mm, length 20 mm.
16. Mild steel rings - 2 No. diameter 200 mm, length 15 mm.
17. Eye on handle bars - 2No. diameter 10 mm round steel bar of length 160 mm.
18. Triangular reinforced plates 40 x 40x 4 mm thick.

III. TECHNOLOGY DEVELOPMENT PROGRAMME (TDP) LABOUR-BASED COMPACTION METHODS FOR RURAL ROADS

Presented by Dr. A. L. Kyulule Faculty of Engineering, Department of Civil Engineering University of Dar es Salaam

1.0 INTRODUCTION

1.1 Background

Due to lack of heavy compaction equipment, many developing countries have been forced to execute most of their road construction works on labour-based methods, this being particularly true in the rural areas. Table 1.1 gives some examples of semi-equipment and labour-based compaction methods commonly used in developing countries.

Table 1.1: Semi-Equipment and Labour-Based Compaction Methods

	Engine - Powered	Muscle - powered
Semi-equipment intensive	Agricultural tractor-towed sheepsfoot roller, traffic compaction (vehicles), Agricultural tractor-towed smooth roller, Agricultural tractor-towed tyred cart, Hand-held mechanical plate or roller, Pedestrian rollers (self propelled)	Animal-towed sheepsfoot roller, animal or huma-towed smooth roller. Animal or human-towed vibrating roller.
Labour-based		Animal or human-feet, Handhammer, weight released from tripod

1.2 Research Problem

The research work will focus on labour-based compaction methods for rural roads. The intention is not to look at the methods that achieve 95 % to 100 % dry densities on thick pavement layers, this is already well documented. Tractor towed dead weight rollers or self propelled vibrating rollers are the minimum level of equipment required to achieve this. What is necessary is to look at the effectiveness of light

animal or human towed compactors on new road construction.

1.3 Justification and Relevance of Research

Although issues pertaining to labour-based compaction in developing countries have been reviewed before in various parts of the world, a systematic and analytical study has not been forthcoming. This research work is intended to fill that gap. Limitations of labour-based compaction techniques as well as appropriate field control tests will also be examined. The study will result in the selection of the most suitable compaction methods for rural roads and will greatly enhance the execution of the 'Integrated road Programme' which Tanzania is currently undertaking. The application of the research findings in Kenya, Tanzania and Zambia is expected to result in considerable economic gain for the entire region. It is also expected that the research findings will be included in the Curriculum of the University for undergraduate studies.

1.4 Literature Survey

A number of literature on labour-based compaction of rural roads will be reviewed. The main sources are experiences gained from Kenya, Ghana, Thailand, Lesotho, Botswana, Namibia and other developing countries undertaking labour-based construction of rural roads.

2.0 OBJECTIVES

The research work, as introduced above, will be carried jointly between the Department of Civil Engineering at the University of Dar es Salaam and the International Labour Organisation (ILO).

The objectives of the research work shall be:

- (i) To investigate the effect of light-weight human or animal-drawn compaction equipment of rutting (i.e. tyre penetration into the fill material).
- (ii) To investigate whether light-weight compaction equipment produces a smooth road surface resulting in improved drainage of the surface
- (iii) To investigate the depth in the road fill to which reasonable compaction is achieved by light-weight compaction.
- (iv) To conclude whether light-weight compaction does offer any advantage at all over the current approach of leaving compaction to the consolidating effect of traffic.

3.0 METHODOLOGY

The research and development work would consist of studies and investigations which will be carried out in the field as well as in the Soil Mechanics Laboratory of the University of Dar-es Salaam. The research will be divided into two main phases:

PHASE 1: Field and Laboratory Tests

The human-towed smooth wheel steel roller will be manufactured at the Institute of Production Innovation in Dar es Salaam. Field tests will be set up in Kisii and Nyanza Province in Kenya; Kilimanjaro and Mbeya in Tanzania; and Kasama in Northern Zambia. Figure 1 shows typical test sections to be set up at each location.

Soil samples will be taken from each test area for testing and analysis in the Soil Mechanics laboratory at the University of Dar es Salaam.

Gravel compacted Gravel compacted No gravel placed Gravel placed Gravel placed normally, using haulage using hand-towed yet (to be placed after immediately immediately equipment roller 6 months) and compacted & compacted by hand-towed tractor towed roller roller

Formation not Formation not Formation compacted Formation Formation compacted, left for compacted left for at each of the 3 stages compacted at compacted at 6 months under traffic 6 months under traffic by hand-drawn roller each of the 3 each of the 3 stages by hand stage by drawn roller tractor-towed roller

In addition to field trials using human-drawn smooth roller, the following tests will be conducted in the field:

- (1) Determination of moisture content
- (2) Determination of density using the sand replacement method
- (3) Determination of variation of density with depth using the TRRL penetrometer equipment.

PHASE 2: Monitoring of Performance of Test Sections

Test sections at the various locations will be monitored with respect to the following aspects:

- (a) Rutting (i.e. tyre penetration into the fill material) after a specified period.
- (b) General settlement pattern of the fill material after a given period.
- (c) Erosion patterns on fills to establish the influence of compaction using light-weight equipment on drainage.

4.0 TIME SCHEDULE

The research work is expected to last for a total duration of 1.2 years. Phase 1 which involves field tests and laboratory tests is expected to last for a period of 4 months. Phase 2 which involves monitoring is expected to last for period of 9 months. Appendix 2 shows the detailed time schedules of activities.

5.0 REPORTING

In the course of the research work a total of 2 reports will be submitted, i.e. one progress report at the completion of phase 1 and a final report at the completion of phase 2.

6.0 COST ESTIMATES

Given below is a summary of cost estimates for the research work. The breakdown of the financial requirements can be seen in Appendix 1.

1. Phase 1: Field and laboratory tests: TShs. 1,091,738.00

2. Phase 2: Monitoring of performance of test sections TShs. 496,000.00

Total Costs for Research Tshs. 1,746,511.80

APPENDIX 1: DETAILS OF FINANCIAL REQUIREMENTS

Phase 1:

1.0 Field and laboratory tests Amount (Tshs)

1.1 Initial visits to Tanga, Kilimanjaro

Mbeya and Kasama (Zambia) to prepare for field tests

Honoraria

- 0.5 man-month researcher (Kyulule)

$0.5 \times 88,000 = 44,000.00$

Per diem 15 days $\times 4,800 = 72,000.00$

The costs for visit to Kasama (Zambia)

Will be paid separately using external funds.

1.2 Manufacture of human-towed

1.2 tonnes smooth wheel steel roller 372,738.00

1.3 Execution of field compaction trial tests

(i) At Kisii and South Nyanza (Kenya),

researcher (Kyulule)

Costs for the researcher to be covered using

external funds.

Anticipated duration 2 weeks.

(ii) At Tanga, Kilimanjaro and Mbeya (1 month)

Honoraria

1.0 man-month, researcher (Kyulule)

$1.0 \times 88,000 = 88,000.00$

Man-month, technician (Mwaisanila)

$1.0 \times 44,000/= 44,000.00$

Per diems

30 days x 4,800/= (Kyulule) 144,000.00

30 days x 4,800/= (Mwaisanila)

(iii) At Kasam (Zambia), researcher (Kyulule)

Costs for the researcher to be covered using external funds.

Anticipated duration 1 week.

1.4 Soil sample testing at the Soil Mechanics Laboratory,

University of Dar es Salaam

Classification tests

(30 samples, i.e. 5 samples from each test area)

Honoraria (Technician, Mwaisanila)

$21 \text{ man-days} \times 2000/= 42,000.00$

Machine charges 30 tests x 1,200/= 36,000.00

Standard compaction tests

(30 samples, i.e. 5 samples from each test area.)

Honoraria (Technicians Kisimbo, Mwasanila)

$21 \text{ man-days} \times 3,000/= + 21 \text{ man-days} \times 2,000/= 105,000.00$

Phase 2

2.0 Monitoring of performance of test sections

(i) At Kisii and South Nyanza (Kenya)

Costs to be covered using external funds.

Anticipated duration, 2 weeks.

(ii) At Tanga, Kilimanjaro and Mbeya (1 month)

Honoraria

1.0 man-month researcher (Kyulule)

$1.0 \times 88,000 = 88,000.00$

Per diem 30 days $\times 4,800 = 144,000.00$

(iii) At kasam (Zambia)

Costs to be covered using external funds.

Anticipated duration, 1 week.

2.1 Data analysis and report writing, researcher (Kyulule)

3 man-months $\times 88,000 = 264,000.00$

SUBTOTAL TShs.1,587,738.00

BICO Charges 10% TShs. 158,773.80

TOTAL COSTS FOR RESEARCH: TShs. 1,746,511.80

DISCUSSION

Rollers

The disappointing durability of the light pedestrian roller was a surprise to many participants. That piston rings on pedestrian rollers used in Lesotho needed replacement already after 3 months is serious. However, it was pointed out that some problems were caused by careless operation and a lack of or incorrect maintenance of the equipment. Problems decreased considerably after operators had been trained in preventive and routine maintenance and correct operation of the equipment.

In Mozambique the experience with vibrating rollers has also been poor. Currently, the project uses tractor towed vibrating rollers. These also have not been very reliable.

Towed rollers are difficult to use on narrow mountain roads where there is limited space for turning. However, this problem can be reduced by using longer pitches.

In Madagascar the roads authority applies the same compaction specifications to labour-based and equipment-based works. Contractors there use heavy static towed and self-propelled rollers, because they are given on loan by the Ministry on the condition that the contractors repair and maintain them.

Natural Compaction

Traffic compaction and natural consolidation have been proven effective on several projects. In the rural Access Road Programme in Kenya deformation due to absence of compaction was compensated by reshaping works in the initial period after the road section was completed. Also some experimentation with light compaction by manual/donkey/oxen towed rollers was done. Although there are no data collected on this issue, not compacting and reshaping the deformed road as an (extra) maintenance activity appears to be both cheap and effective. The increase in vehicle operating costs has not been measured, but the roads concerned only receive a traffic of less than 30 VPD, so this cost increase is not significant.

The effectiveness of natural compaction for these type of roads has been confirmed by the Transport and Roads Research Laboratory (Study unpublished). For gravel and earth roads the limited deformation is simple and cheap to rectify. However, in the case of bitumen surfaced roads insufficient compaction will lead to the destruction of the surface layers, which implies that high compaction standards are required.

Separate guidelines are needed on how and when to apply natural consolidation and traffic compaction for earth and gravel works. The effect of using light weight rollers to reduce the rutting in the initial phase should be further investigated.

Dry Compaction

The Kenyan experience with natural consolidation and traffic compaction has been obtained in areas with sufficient rainfall. However, soil and climatic conditions differ considerably on the various labour-based programmes. In Mozambique for example water has to be brought in by bowser or compaction has to be restricted to the 2 months per year with rainfall. Data on dry compaction would be useful for arid areas with poor access to water.

The TRRL are currently doing research on dry compaction with heavy vibrating rollers in arid area in Kenya. In Namibia several studies on this topic have been undertaken using different methods, materials and maintenance systems. However, it was found that the use of water still gives the best results. Therefore, temporary pipelines have been laid from boreholes along the road alignment to the construction sites.

Guidelines

There is a great demand from countries establishing labour-based road programmes for guidelines on appropriate compaction methods and standards.

In the past, the choice of compaction methods has been more determined by factors such as funding, available equipment, mechanical maintenance facilities or previous practice than by scientific data.

As described in the papers presented, several viable and appropriate methods of compaction have been developed for labour-based road construction works. These methods will have to be incorporated in a database and accepted as viable and credible engineering.

Special attention should be given to this issue when introducing contractors to labour-based works. It is then important that compaction specifications are adapted to the use of labour-based methods and that appropriate compaction methods are introduced and standardised.

During the meeting an ad hoc committee of interested participants was set up to formulate their requirements. They were also requested to comment on Dr Kyulule's compaction study proposal to ASIST by mid April 1992.

SESSION 6: INTERNATIONAL LABOUR STANDARDS

Summary

The ILO involvement in labour-based road programmes stems from its interest in assisting governments of developing countries with the application of the Employment Policy Convention, 1964 (No. 122). This convention is concerned with the promotion of full employment with a view of stimulating economic growth and raising standards of living. However, experience shows that several other international labour standards related to issues such as forced labour, equality, freedom of association, protection and determination of wages are relevant and should be considered when designing and implementing labour-based projects.

Technical advisers from the ILO and other institutions are obliged to ensure that ratified conventions and human rights are not violated in their projects.

Jan de Veen presents examples how relevant ILO standards have been applied in ILO executed road projects and Corinne Vargha gives an overview of the most important labour standards for labour-based programmes.

- I. [The Application of Labour Standards in ILO Supported Road Sector Projects](#) - by Jan de Veen.
- II. [Summary of the International Labour Standards](#) - by Corinne Vargha.

I. THE APPLICATION OF ILO STANDARDS IN ILO SUPPORTED ROAD SECTOR PROJECTS

Presented by Jan de Veen, International Labour Office, Geneva

CONSTRUCTION AND REHABILITATION

The ILO involvement in road sector programmes stems directly from its interest in assisting governments of developing countries with the application of Employment Policy Convention, 1964 (No.122) and the accompanying Employment Policy Recommendation, 1964 (No.122). These are concerned with the establishment of an active policy to promote full, productive and freely chosen employment and make specific references to the promotion of rural employment through public works projects. Therefore, in the road sector - which accounts for 30 to 50 % of total public expenditure in most developing countries - the ILO provides technical assistance to introduce alternative employment-intensive approaches into ongoing programmes of road construction and maintenance. This is done through pilot/demonstration projects with substantial training components. The principal objective of this technical assistance is to modify road construction and maintenance policies from predominantly equipment- and capital-intensive to labour-based and orientated to a maximum use of locally available human and material resources.

In order to create a significant and lasting impact on the employment situation however, ILO-executed pilot projects should lead to large scale nationally sustained programmes. This will only be achieved if governments and financing agencies are convinced of the technical and economic viability of the proposed methods. Only then will employment-intensive programmes be accepted as sustainable and durable alternatives to current approaches, instead of being considered as relief programmes.

The viability and sustainability of labour-based road construction/rehabilitation and maintenance works

is determined by three factors: costs (should be competitive with machines), quality (should be comparable with machine work), and speed (depends on the local capacity to manage large labour forces and, of course on the availability of labour in the areas concerned). Therefore ILO road sector projects focus on demonstration, management training, system development, and data collection. The objective of this work is to convince policy makers, technicians and financing agencies that labour-based work methods are worthwhile and to lay a sound basis for a nationwide programme.

Although for these reasons, an emphasis is given by ILO pilot projects to technical, economical and managerial considerations, numerous opportunities exist to influence work methods and work behaviour through training and demonstration. Training is given to different categories of people (Government staff, contractors, village representatives) and at different levels.

Subjects include recruitment procedures, administrative systems, payment, work organisations and methods etc. Items like female participation, legislation on child labour, equal remuneration, conditions of work (availability of food and water, protective clothing, good quality and ergonomic hand tools, etc.), wage levels and methods of payment are being discussed and brought into practice on practical training sites.

A further important issue which can be positively influenced by the pilot/demonstration projects is the social security situation of the road construction and maintenance workers. It should be recognised however that in this regard the projects can only play a restricted promotional role for two reasons: (i) in most developing countries the general lack of financial resources means that even the existing social security systems are not functioning satisfactorily (ii) by their very nature road sector projects carried out by the ILO deal primarily with un-organised casual workers for whom social security arrangements do not exist.

At the pilot/demonstration stage discussions can also be entered into with employers' and workers' organisations or, if these do not exist at the project levels, their creation can be encouraged (see Ghana below). In this context it should be noted that most of the ILO road sector projects operate depend to a great extent on the level of effectiveness of the country's legal system. The less effective this system is the more difficult it will be to influence and control the application of ILO standards, particularly in respect of the large groups of un-organised casual workers. Also, the degree of difficulty encountered in this field is largely determined by the poverty level in the country concerned; the poorer the country, the more likely it is for example that child labour is a regular feature of the society. Nevertheless, ILO projects can, and do, have a role to play in demonstrating the practical application of ILO standards.

Examples of the promotional role of ILO-executive road sector projects in respect of the application of relevant ILO standards

Practical examples of the application of ILO Conventions in roads sector projects include projects carried out in Botswana, Ghana, Madagascar, Tanzania and Zambia.

In Botswana, women participation was actively encouraged and reached 37 % of the total labour force. Also, women participation in training has been actively promoted and in 1990, the percentage of women doing supervisory and management work reached 60 % at team leader level, and 20 % at technical officer and technical assistant level. The Programme has broken stereotype barriers in that it employs women on what is generally regarded as "men's work". The Programme has also consistently advocated the use of appropriate wage standards for casual work carried on road construction in rural areas.

An interesting result of an ILO project of contractor training in Ghana was the formation of an Association of Labour-based Contractors, an example of a practical application of the Convention of Freedom of Association. The same project has officials of the Ministry of Labour participate in meetings where tenders are invited for public works: the entrepreneurs who fail to comply with the social clauses laid down by that ministry are disqualified; moreover, the labour inspectorate is responsible for seeing that these clauses are applied. The Ghana project also ensured that children accompanying and assisting their parents were sent home.

In Madagascar, contractors were encouraged to employ women as labourers on rural road rehabilitation projects reaching a level of 25 % of the labour force. The contracts included clauses prohibiting the use of labourers below the age of eighteen years.

In Tanzania the ILO has ensured that where the work is not directly benefiting the workers they are fully remunerated. Equally great care has been taken to ensure that the context of "self-help" actually originates from the beneficiaries and is not used as a development tax.

In Zambia, female participation both in the labour force and at supervisory levels has been actively promoted and led to significant percentages of women being employed at all levels.

Within the framework of ILO projects labourers are paid in these countries according to the minimum wage legislation of the country concerned. This means that payments are made at wage levels laid down by the Government for the category of workers concerned (casual workers carrying out construction work in non-urban areas), or else at the prevailing wage rate in the area. This applies even where a system of payment by results is used (as in Ghana) since the wage fixed for the task may be equal or higher than the basic remuneration and the bonus is either in the form of cash or free time (a worker having completed his task can leave the site). Where food is used as a work incentive in "Food for Work" schemes, the general WFP/ILO agreement that the workers should receive a minimum cash remuneration equal to 50 % of the official minimum wage, is applied.

MAINTENANCE

A very important field both in relation to sustainability and ILO standards is maintenance. Again the main interest of the government agency and the financing institution is that the work should be technically and economically viable. Again therefore the alternative employment-intensive road maintenance approaches advocated by the ILO must be proven to be competitive in terms of costs, quality and reliability.

The ILO projects aim to introduce village agreements, contracts with individual workers living along the roads and decentralised supervision and payment procedures. These approaches have proven to be both effective and economical. Nevertheless, both governments and financing agencies often exert a great deal of pressure to use un-paid village labour as a "self-help" contribution to road maintenance works. Here particularly there is a considerable risk of abuse of the communal labour spirit. The structured use of un-paid labour for road maintenance is only in special cases in line with the ILO Conventions regarding forced labour. This is when a village on its own account has identified road maintenance as a top priority and applies for external assistance (supervision, construction materials, tools) in order to complement the labour for - by definition - long term road maintenance works would go against the spirit of the conventions on forced labour. The ILO projects have dealt with this problem in two ways. First, in the project design un-paid maintenance labour is never considered an option; second, in cases where governments/financing agencies insist on an experimentation of road maintenance methods using

village contribution, the ILO project would advocate the introduction of monetary and non-monetary and incentives and critically study the cost effectiveness and results of the scheme concerned. Invariably it is shown that the use of communal labour in this way is inefficient, leads to high overhead costs and poor quality results, and is not sustainable in the long term.

CONCLUSION

The use of casual labour in the context of road sector works is open to abuse given the general lack of formal structures of labour administration in the rural areas in developing countries. It is therefore particularly important that the ILO is present in road infrastructure programmes to ensure that not only productive employment is created but also that exploitation and abuse of workers is avoided.

II. SUMMARY OF THE PRESENTATION ON INTERNATIONAL LABOUR STANDARDS

Presented by Corinne Varga, Liaison Officer for ILS/TC ILO Regional Officer for Africa, Abidjan

This presentation is based on the discussion paper prepared by the Regional Adviser on Standards, Mr David Tajzman, which has been distributed to all the participants. It has two objectives. First, to give the participants an overview of national and International Labour Standards (ILS) in six major areas: Forced Labour, Equality, Freedom of Association, Child Labour, Protection of Wages and Determination of Wages. And secondly, to open for discussions strategies for relating national and international labour standards to road construction and maintenance activities.

INTRODUCTION

Mandate of the ILO and Means of Action

The ILO was created in 1919, after the first world war, since lasting peace can be established only if it is based on social justice. The basic principles on which the ILO is based are in this respect:

- labour is not a commodity
- freedom of expression and of association are essential to sustained progress,
- poverty anywhere constitutes a danger to prosperity everywhere.

To achieve its mandate of promotion of social justice, the ILO has two main means of action: International Labour Standards and Technical Cooperation.

Standard-setting Activities

Being a normative organisation, ILO has given birth to a system of International Labour Standards which take the form of Conventions and Recommendations. By the end of June 1991, the International Labour Conference has adopted 172 Conventions and 179 Recommendations, covering issues such as basic human rights, employment, social policy, labour administration, labour relations, conditions of work, social security, employment of women, children and young persons. The Convention, which is an international treaty, is binding for the country. It means that the country has to apply its provisions, to adopt national law and practice to its requirements and to accept international supervision. Contrariwise, Recommendations set non binding guidelines which may orient national policy and practice. The ILO does not only elaborate and supervise the application of International Labour Standards, it also promotes

them. In this respect, four types of action are undertaken: missions to countries and the organisation of training sessions, technical cooperation on standards themselves to assist their implementation, dissemination of legislative information and liaison with ILO technical co-operation projects.

1. RELATING INTERNATIONAL LABOUR STANDARDS TO TECHNICAL COOPERATION PROJECTS - BASIC PRINCIPLES

WHICH ILS

- Basic Human Rights Standards: Freedom of Association, Forced Labour, Equality of Opportunity and Treatment.
- Conventions ratified by the country in which the project is taking place.
- Standards which have a "natural link" to the conduct of the project, whether or not they have been ratified by the country in which the project is implemented.

METHODS OF APPLICATION

TWO STRATEGIES

RESPECT OF ILS	PROMOTION OF ILS
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*By avoiding activities in the project which would be contrary to ILS principles.
By undertaking specific promotional activities, whenever possible.*

2. RELATING ILS TO LABOUR INTENSIVE ROAD CONSTRUCTION AND MAINTENANCE PROJECTS: SIX MAJOR AREA

2.1 FORCED LABOUR: Conventions No. 29 - Forced labour, 1930

Conventions No.105 - Abolition of forced labour, 1957

Aim of Convention No.29: Suppression of forced labour
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The fundamental commitment made by State ratifying the Convention is to suppress the use of forced or compulsory labour in all its forms in the shortest possible time.

The Conventions does not apply to five categories of work or compulsory services subject to certain conditions and guarantees:

- a) compulsory military services
- b) certain civic obligation
- c) prison labour
- d) work exacted in cases of emergency
- e) minor communal services

The Convention requires meaningful penalties to be imposed upon those who exact forced labour.

Aim of Conventions No. 105; Prohibition of the recourse to forced or compulsory labour in any form for certain purposes:

- a) as a means of political coercion
- b) as a means of mobilising and using labour for purposes of economic development
- c) as a means of labour discipline
- d) as a punishment for having participated in strikes
- e) as a means of racial, social, national or religious discrimination

Definition of forced labour in terms of ILS: "All work or services which is exacted from any person under the menace of any penalty and for which the said person has not offered himself voluntarily."

But some type of labour which would otherwise be considered forced according to this definition are specifically excluded as such by Convention 29.

Definition of forced labour in the national standards: Most of the 9 countries reviewed have included some definition of forced labour. Some define it identically to the international labour standards, some differently, and a few others do not provide a definition at all, simply declaring forced labour unlawful.

2.2 EQUALITY - Convention No. 100 and Recommendation No. 90 - Equal remuneration, 1951
- Convention No. 111 and Recommendation 111 - Recommendation (Employment and Occupation), 1958

Aim of Convention No. 100: Equal remuneration for men and women for work of equal value.

By ratifying this Convention, the State commits itself to promote the application of the principle of equal pay for work of equal value between men and women. Where the State is in a position to influence the wage-fixing process it is obliged to ensure implementation of the principle. In all other cases, the State must actively promote application of the principle.

This principle goes beyond equal pay for men and women doing the same job; it means that men and women who do jobs - whether the same or not - which have the same value should be equally remunerated.

Aim of Convention No. 111: To promote equality of opportunity and treatment in respect of employment and occupation.

The ratifying State has to declare and pursue a national policy designed to promote equality of opportunity and treatment in respect of employment and occupation. Discrimination is defined as any exclusion, distinction or preference based on race, colour, sex, religion, political opinion, national extraction or social origin, or any other basis the State itself might declare. The state may not itself

discriminate on these bases in respect of employment and occupation and has to work to eliminate discrimination in private sector employment by appropriate means to national conditions and practice.

This Convention includes:

- direct as well as indirect discrimination,
- Vocational training, access to employment and conditions of employment.

Is not considered as discrimination:

- employment decisions based on inherent requirements of a job,
- measures aimed at remedying discrimination (some times called "positive discrimination").

National standards: Some countries have laws which prohibit discrimination in employment but which do not automatically include all the bases of discrimination defined in the Convention. A number of countries omit the political basis. None of the countries have laws specifically addressing equal pay for equal work.

2.3 FREEDOM OF ASSOCIATION

- Convention No. 87 - Freedom of association and protection of the right to organise, 1948
- Convention No.98 - Right to organise and collective bargaining, 1949
- Convention No. 141 - Rural workers' organisations, 1975
- Convention No.135 - Workers' representatives, 1971
- Convention No. 154 - Collective bargaining, 1981

Aim of Convention No. 87: The right, freely exercised, of workers and employers, without distinction, to organise for furthering and defending their interests.

Four basic elements:

- 1) workers shall enjoy adequate protection against acts of anti-union discrimination,
- 2) workers' and employers' organisations shall enjoy protection against acts of interference by each other,
- 3) machinery shall be established for the purpose of ensuring respect for the right to organise,
- 4) measures shall be taken to encourage and promote the development and use of voluntary collective bargaining.

Aim of Convention No. 141: Freedom of association for rural workers, encouragement of their organisations and their participation in economic and social development.

This convention requires the ratifying members to adopt and carry out a policy of active encouragement or rural workers' organisations.

Aim of Convention No. 135: Protection of workers' representatives in the undertaking, facilities to be afforded to them.

The ratifying State has to establish protection against discrimination in employment because of status as a worker representative. It also requires that appropriate facilities be afforded worker representative for carrying out their functions.

Aim of Convention No. 154: It furthers the objectives of principles laid out in Convention No. 98 concerning the promotion of free and voluntary collective bargaining.

National Standards

The provisions are too numerous to be fully examined here. But a few characteristics will be examined concerning:

- registration requirements of employers' and workers' organisations
- single national trade union movement
- restrictions on political activities
- collective bargaining

2.4 CHILD LABOUR

- Convention No.5 - Minimum Age (Industry), 1919
- Convention No.59 - Minimum Age (Industry) (Revised), 1937
- Convention No. 138 - Minimum Age, 1973

Aim of Convention No.5: Children under age of 14 shall not be employed or work in any public or private industrial undertaking. The industrial employers shall be required to keep a register of persons under the age of 16 employed by him, as well as their date of birth.

Aim of Convention No.59: It increases the minimum age to 15 years but permits children to be employed in undertakings where only members of the employer's family are employed (except in dangerous employment). It requires the employer to keep a register of persons under the age of 18 employed by him and the date of their birth.

Aim of Convention No. 138: The abolition of child labour. The minimum age of admission to employment or work shall not be less than the age of completion of compulsory schooling (normally not less than 15 years). Developing countries may initially specify a minimum age of 14 years.

The minimum age shall not be less than 18 years - or 16 under certain conditions - for any type of work and employment which is likely to jeopardise the health, safety or morals of young persons.

The scope of work or employment covered by the Convention can also be limited upon ratification; however, construction activities must be covered. Greater flexibility is also provided in the field of light work. Minimum of 15 becomes 13 and minimum of 14 becomes 12.

General exception in the three conventions: work or employment done by children in technical schools.

National standards: All the countries considered here have laws prohibiting the employment of persons below a certain age.

2.5 PROTECTION OF WAGES - Convention No.95 and Recommendation No. 85 - Protection of Wages, 1949

Aim of Convention No. 95: Full and prompt payment of wages in a manner which provides protection against abuse.

The aspect of International Standards which is important to note in respect of ILO road projects pertains to payment in kind, particularly in the form of food: appropriate measures will be taken to ensure that such allowances are appropriate for the personal use and benefit of the worker and his family and that the value attributed to such allowance is fair and reasonable.

Fair and reasonable means:

- where food is a component of remuneration, workers are entitled to receive at least 50 per cent of their wages in cash.
- where the market value of the food is higher than its nominal price, the cash component should be at least 50 per cent of the wages or the applicable minimum wage for the particular type of work involved.

National standards: Most of the countries make some provisions for the protection of wages along the lines set out in ILS but few make provisions as detailed in the convention.

2.6 DETERMINATION OF WAGES

- Convention No. 26 - Minimum Wage-fixing Machinery, 1928
- Convention No. 131 - Minimum Wage-fixing, 1970
- Convention No. 94 - labour Clauses (Public Contracts), 1949.

Aim of Convention No. 131: Protection against excessive low wages.

It requires the establishment of a system of minimum wages which covers all groups of wage-earners

whose terms of employment are such that coverage would be appropriate: Minimum wages so established must have of law and failure to pay them must be penalised.

Aim of Convention No.26: It requires only that a machinery be maintained whereby minimum rates of wages can be fixed for workers employed in certain trades in which no arrangements exist for the regulation of wages by collective agreement or otherwise and wages are exceptionally low. If a minimum wage is fixed, it must be done with certain involvement of workers and employers and the rates must be legally binding and not subject to abatement.

Aim of Convention No. 94: To ensure minimum labour standards in the execution of public contracts.

Public contracts should include clauses ensuring to the workers concerned wages, hours of work and other conditions of labour which are not less favourable than those established for work of the same character by national laws or regulations, collective agreements, or the general level observed in the trade or industry concerned.

National standards: Most of the countries have established systems for setting minimum wages but only a few have recently set minimums which have effect, by their terms, on the construction industry.

SESSION 7: TECHNICAL ENQUIRY SERVICE

Summary

The ILO has designed a programme to provide advisory support, information and training (ASIST) to labour-based road construction and maintenance programmes in Sub-Saharan Africa with the main objective of increasing the efficiency of the management of the programmes. One of the outputs to achieve this goal is to provide a service of information collection, research, collation and distribution on subjects related to this technology. A Technical Enquiry Service within ASIST located at the Kisii Training School in Kenya have now been established to provide these services.

During this session the participants were requested to prioritise their information and research requirements, and to make themselves available as resource persons on specific subjects.

Before this exercise Bjørn Johannessen and Gerrit Bosma gave a briefing on the purpose, development and current status of the Technical Enquiry Service.

- I. [Technical Enquiry Service - Background and Current Status](#) - by Bjørn Johannessen and Gerrit Bosma.
- II. [Analysis of Needs](#) - by Gerrit Bosma

I. TECHNICAL ENQUIRY SERVICE

Background and Current Status

Presented by: Bjørn Johannessen ILO, Geneva and Gerrit Bosma Technology Specialist ,ASIST,Kenya

Background

In 1988 the ILO and the Swiss Agency for Development Cooperation (SDC) in collaboration with the Ministry of Public Works in Kenya developed and presented an international course for civil engineers and project managers on the subject of labour-based road programme management.

In June 1990 a project planning workshop was held in Kenya to review the results of this project and to plan a new phase to consolidate and expand on the achievements of the first phase. Participants to this workshop included representatives from the SDC, ILO, ESAMI, the Government of Kenya, rural roads authorities from Tanzania, and Ghana and past course participants.

The workshop concluded that the project had reached its immediate objectives in providing an appropriate course to senior staff in labour-based programmes. However, the workshop agreed that a number of complementary activities were necessary to achieve the higher objective of the project, namely:

Increased effectiveness of labour-based programmes in Sub-Saharan Africa.

In order to achieve this objective 5 project outputs were identified:

- (i) engineer and site supervisor training
- (ii) senior management orientation

(iii) training of trainers

(iv) information services

(v) research and development

In order to secure these outputs, it was envisaged that the ILO under its Regional Advisory Services Project would manage a project which would consist of:

- a training adviser based in Nairobi to organise the courses identified under the outputs i, ii and iii, and
- a labour-based technology adviser based in Kisii to create and run a Technical Enquiry Service covering outputs iv, and v.

The activities to be undertaken by the Technical Enquiry Services was further specified as described in the following two tables:

OUTPUT IV			
OBJECTIVE	SPECIFICATION		
	WHAT	KEY SUBJECTS	TARGET GROUPS
Labour-based roadworks information made available to practitioners in sub-Saharan Africa	- Published material - Unpublished material - Database of expertise - Information on - research - Summary results - Data base on - Suppliers	- Programme - Equipment - standards & designs - structures - systems -contractors	- Programme Managers - Technical Specialists - Training institutions - Course participants

ANNUAL REGIONAL LABOUR-BASED SEMINARS

ACTIVITIES		
Determine priority information needs	Initiate computerisation of material	Disseminate required Information
Collect, review and summarise literature	Distribute and support appropriate computer systems	Conduct regular labour-based seminars and publish proceedings
Store and catalogue material		

OUTPUT V

OBJECTIVE	SPECIFICATION	
Technology information available to labour-based programmes improved.	Design and Specification for : - compaction equipment - trailers - hitches - culvert moulds - towed graders	Construction and maintenance techniques for: - setting and drainage provision - black cotton soil - maintenance systems - surfacing material

Standard designs for structures (Low cost local resources)

ACTIVITIES		
Review on-going research Identify more areas to be researched Prioritise areas to be researched	Prepare necessary resources for research (identify institutions and people) Carry out research (Contract out or carry out in Kisii)	Evaluate researched product and publish Test and verify information on technologies

The project has now commenced. Mr Gerrit Bosma took up his assignment as Technology Specialist in October last year and mr John Omwansa was recruited in September last year as a national professional to assist in the establishing and running of the Technical Enquiry Service.

Before the experts were recruited EMP/INFRA engaged two consultants to prepare recommendations on how to organise the service and also to extract experience gathered by related institutions such as ILO library, ITDG, INSTEAD, etc. The final reports were discussed in detail during a meeting in Geneva where the regional Adviser mr David Stiedl and the Technology Specialist together with EMP/INFRA staff produced a preliminary action plan for the Technical Enquiry Service.

Of the two information consultants hired by EMP/INFRA, doing preparatory work, Angus Austen, proposed a production strategy for information/training materials and delivery and defined information packages containing modules for specific (13) target groups (report: **A**Strategies for Development & Delivery of Information on Labour-based road Works@by Construction Advisory and Training Services Ltd.

The second consultant, Kanyhama Dixon-Fyle, mapped out the aspects of information technology in general and the sections within ILO-Geneva that are concerned with information collection, processing, storage and dissemination (report: **A**Preparatory report for the Design of a Technical Enquiry Service@, July 91, and **A**Stage II of preparations for the Design of a technical Enquiry Service@, October 1991, by Kanyhama Dixon-Fyle).

The technology specialist was thoroughly briefed and introduced to ILO officials, concerned with information technology, during his mission to Geneva. In October a useful visit to a successful operational enquiry service (ITDG-Rugby, UK) was made afterwards.

A consultant, Dr Bambrah in Nairobi assisted David Stiedl in the design of an operational strategy (report: ~~A~~Overview and Proposals@to ASIST programme by Dr G.K Bambrah, October 1991).

During meetings in October 91 (for minutes see section 1, chapter 2 and 3 of report ~~A~~Stage 2 of prep. For design of TES by K. Dixon-Fyle, October 1991) a number of issues were clarified.

- the immediate target group were to be practitioners in Sub-Saharan Africa. TES is not only the future EMP/INFRA information service, with an extended target group, but will be part of it (min. 6,8).
- The information needs of the target group will be identified in the Annual Regional Seminars (min.10).
- The TES will be directed by the ASIST Programme Director (min.5).
- R&D and TES are equally important within the ASIST Programme Director (min.5).
- Due to unreliable communications with Kisii, information will go via the Nairobi office.
- For the function of information specialist (national expert) an engineer with labour-based background with interest in computing is preferred above a librarian (min.19)
- TES should be operational soon even at the expense of the quality of document processing (min.11).
- Processing of documentation will be done in Kenya, data system and terminology should remain compatible with the ILO library, future EMP/INFRA database system and should not be too specialised (min.13, 16, 18).
- EMP/INFRA professionals will select recommended material and value their contents (min.1, 26).
- EMP/INFRA will produce key concepts to be used for abstracting (min.15, 20).
- Especially on other issues than labour-based technology good referral services should be provided.
- Topics of material to be acquired were divided as follows (table 3.1):
 1. programme and project experiences
 2. tools and equipment
 3. standards and design
 4. maintenance
 5. administrative and monitoring systems
 6. contractors
 7. ILO conventions and recommendations
- The sources of material, concerning above mentioned topics, to be collected and stored were defined as follows:
 1. periodicals
 2. firms
 3. ILO published

4. ILO unpublished

5. people

6. institutions

- The topics Tools & Equipment (an ASIST priority) and Administration & Monitoring Systems (an EMP/INFRA priority), and all ILO published and unpublished material, were prioritised (min.25)

Proposed Set-up

The TES/R&D team is designed to contain 1 technology specialist, 1 information specialist and 1 R&D specialist. Occasionally the team may receive assistance from a student/apprentice or librarian.

Acquisition of documents will depend on the priorities set by the seminar, ASIST and EMP/INFRA. Since acquisition will occur at regular intervals the document processing is expected to become a continuous activity for this year.

- We intend to create databases for:
 - Library
 - Technical Enquiries
 - Technical Briefs and Responses
 - Resource Persons
 - Resources for Referral Information
 - Addresses of Personnel, Projects, Firms, Institutions, etc.

Next to retrieving technical experience from existing reports or documents and approaching identified resource persons, experts should become assertive in publicising their experience. A possibly efficient way of securing technical experience gained in the future is to require reporting on technical aspects in annual and terminal reports of which a copy should be sent to ASIST. Often bad performance of a method or design remains unreported to avoid blame. This attitude will mean that malfunctioning **Abread** and **butter@methods** remain uncriticised.

Dissemination will occur at request. It is however not the idea to distribute publications (originals) of the library, but photocopies, extracts, or letters. Requests for ILO publications can be forwarded to EMP/INFRA. Purchase should happen through EQUIPRO or locally. We may help with addresses of distributors. Promotion or expansion of the target group of the Enquiry Service should occur only when the current target group is relatively satisfied with the service.

Choice of R & D subjects greatly depends on this seminar. Since funds are limited and experiments are likely to become costly, R & D activities should be implemented in projects with project funds and ASIST contribution.

After the seminar has set the R & D subject priorities, it should determine where the experiments should take place. This choice should greatly depend on the projects management's enthusiasm and capability to organize, follow-up and monitor. ASIST's role is limited to assistance in all aspects, that does not need

permanent availability.

State of Affairs

With the assistance of the Kisii Training School, on which premises the ASIST technology unit is stationed, the unit is operational. With the arrival of the ordered photocopier, fax/modem, scanner and more labour-based literature the unit will be independently operational. For library database Micro-Isis is being used. Micro-Isis is a programme specially created by UNESCO and iLo and is widely used in libraries and institutions with large databases. Proper support seems to be available through the Kenyan Isis association. Other databases (skeletons in dBase3 +) for Technical Enquiries, Resources, Volunteers (Resource Persons) and Responses were supplied by ITDG. EMP/INFRA will update us with data on addresses. So far only 2 enquiries (about construction in loose sand, selection of contractors and request for publications) reached us via David Stiedl. Responses were given in the form of photocopies from reports and forwarding the request for publications to EMP/INFRA.

Of the 350 publications ordered or requested from institutions and firms so far 180 documents (mostly from EMP/INFRA) have arrived of which 120 have been summarised.

After summarising the more professional abstracting or indexing, using selected keywords, should take place. Since the retrievability of the content depends on this, we may have to call on a professional indexer (if available) to do this.

The R & D activities so far, testing of the Botswana setting-out system, were a continuation from the activities of the former Technology Unit of the Minor Road Programme of Kenya. The R & D specialist has assisted the roads 2000 project with an introduction to roughness testing with a bump integrator and the compaction study by Dr. Kyulule will soon start.

With the Kisii Training School experts there was discussion on experiments with dressed block paving, alternative culvert ring design and heavy tractor towed roller.

By questionnaire and seminar the practitioners are being sensitised on their information requirements and their expertise, from which other practitioners could profit. This in order to design the strategy for operation and to create a list of resource persons.

In January 1992, 47 questionnaires were distributed to 26 Chief Technical Advisers of which 16 were returned.

I Annex 5 accumulated results are shown. Excluded are sections 3 and 4 on field experience and sources of information.

The results give us the following information;

13 of the 16 practitioners do need an information centre, would use it sometimes (monthly) and on average would have used in 5 2 times last year, mainly for copies of documents, reference and specific technical advice (research).

If the figures are reliable TES should expect from 40 practitioners between 220 and 400 enquiries per year.

All key areas were of interest and specific information requirements were wide spread.

Information requirements to other practitioners and projects are mainly general subjects for counterparts, ministries and department.

Frequently mentioned research requirements are mainly:

1. Low cost compaction, appropriate compaction tests and standards.
2. Equipment and tools
3. Performance of maintenance systems.

For 36 % of the respondents communication is difficult and unreliable. Telex and fax are mentioned as most reliable and are available to 80 % of respondents.

80 % of respondents use the computer for information storage which is more popular than a document centre.

Of the 8 additional comments to the questionnaire 6 were encouraging for TES, one doubts whether experts will be cooperative and one expects that TES will not have a measurable effect of efficiency.

II. ANALYSIS OF DEMAND FOR TES, RESEARCH AD DEVELOPMENT AND LISTING OF RESOURCE PERSONS

Prepared by Gerrit Bosma, Technology Specialist, ASIST

This TES prioritisation exercise will affect in a concertrated effort of collecting material on prioritised subjects. The results were as follows:

Subject	Priority	
	First	Second
1. Project Experience	0	2
2. Tools and Equipment	1	2
3. Standards and Designs	6	2
4. Admin and Monitoring Systems	4	7
5. Contractors	6	3
6. Socio/Economic	1	2
7. Training	0	1
8. Maintenance	6	6
	25	25

Standards and Design, Contractors and Maintenance are clearly first priorities, while administration and monitoring systems is the second priority.

A similar exercise to this TES prioritisation was done for research and development. The list is as follows:

Specific subject		Score
Performance Lengthman - Contractor	maintenance	2
Monitoring of maintenance	"	1
Maintenance prioritisation	"	1
Cost recovery for maintenance	"	1
Economic compaction (incl. arid areas)	Compaction	4
Compaction tests and standards	Standards	1
Road specification and standards	Construction	2
Self help	Community	2
Tools		3
Equipment (including compaction)		7
Surfacing		1
Erosion control		1
General standards		2

More research and development is wanted on equipment, compaction (including arid areas). Together several maintenance aspects also score high.

Finally participants were asked to volunteer to become resource persons to TES. Resource persons will be called upon if TES receives an enquiry for which TES will need the Resource Person expertise. Also in the Research and Development aspect the Resource Person will be invited to involve himself or give an opinion on concerned subjects.

The following participants volunteered:

Subject	Resource Person
Maintenance:	Iddi,Guthrie,Taylor,Bentall,Beusch,
Contracting:	Osei-Bonsu,Bentall,Mahatovo,Gupta (Mad),Berentsen,Guthrie,
Compaction :	Kyulule,Hlaing,Guthrie,Gupta (Mad),Sahle,
Administration and Monitoring Systems:	Taylor,Ariga,Kasani,Bentall,Guthrie,Berentsen,Gupta Mad),
Training:	Jennings,Beush,Ariga,Hlaing,Osei-Bonsu,Guthrie,Watkins.
Design and Standards:	Taylor,Guthrie,Kyulule,Sahle,Bentall.
Tools and Equipment:	Gupta (Moc),Hlaing,Tint Swe,Beusch.

DISCUSSION

Questionnaire

Before this meeting the participants had been requested to fill out a questionnaire which aimed at determining labour-based practitioners' information needs and their present expertise which could be of use to others (the results from this inquiry are presented in Annex 5). A general comment was that such questionnaires must be very specific and that the concerned questionnaire had some questions which appeared to be repetitive.

ASIST Journal

It was felt that the Technical Enquiry Service cannot base its distribution of information only on enquiries from the field, but would have to sell itself and actively promote its services. It was proposed that the TES issues an information journal, say twice a year, presenting its ongoing activities, and available literature.

Each issue should concentrate on one specific subject. It was agreed that the choice of topics should follow the priorities given by the meeting during this session. The first issue should concentrate on labour-based maintenance methods. The contents of this journal could include:

- a listing and summary of key publications and information on the topic in question. It is evident that field management staff does not have the time to study all literature on a given topic but would be interested in maximum 2 to 3 recommended reports covering specific information requirements,
- a description of ongoing activities in the field including contact persons. This could be new pilot projects, ongoing research and development or successfully established projects which may be of interest to replicate in other places,
- relevant information on courses, seminars and workshops. The international labour-based courses in Kisii could be described and advertised here,
- requests to the readers for additional information in the topics covered by the journal.
- a general presentation of the Technical Enquiry Service, what services can be provided, how the information can be obtained, a summary presentation of available literature, etc.

The projects will be the source of information, as well as the target audience. The intention is that the journal should be a means of communication between the various labour-based programmes in the region. The success of a labour-based journal is therefore highly dependant on the response received from the field.

SESSION 8: ACTION PLAN

The participants were requested to identify specific issues under the topics dealt with during the previous sessions which ASIST should follow up on. This could be in the shape of distributing already existing literature and experience, new research and development projects undertaken by the Technical Enquiry Service or by consultants engaged by the TES.

Action Plan for Maintenance

- a) Cost recovery systems for maintenance and user involvement is becoming a big issue for the World bank.

It is necessary to look into decentralised funding and management and possibilities of raising revenue and how road users may be involved.

Experience in maintenance of community water supply and irrigation systems may somehow be replicable to road maintenance.

- b) In many labour-based programmes maintenance is receiving more and more attention. Specific information on the lengthman system describing the organisation, monitoring and reporting forms, payment procedures, task rates, etc. Would be useful for projects which are at the stage of establishing a maintenance system. It would therefore be useful to draw upon the Kenyan experience and produce an annotated maintenance management manual based on the Kenyan Interim Maintenance Manual, maybe including their experience and some possible pitfalls. The copyright issue concerning the Kenyan manual could be resolved by ASIST. The production of such a manual could be an appropriate assignment for a consultant.

Routine and recurrent maintenance through contractors and other proven options could also be included.

- c) Possibilities of minimizing maintenance costs and requirements through modifying road design standards and the maintenance organisation deserves a study since government funding is always insufficient.

An alternative for routine maintenance in sparsely populated areas has been covered by Roads 2000 Project. The technical Enquiry Service can provide the conclusions from this project.

Action Plan for Contracting

- a) There is a great demand for guidelines on establishing appropriate procedures for the involvement of private contractors on labour-based road works as well as reliable unit rates for estimating.

The Entrepreneurship and Management Development Branch (ENT/MAN) of the ILO has published a series of useful manuals on training of small scale building contractors.

The tendering procedures of the African Development Bank are not suitable for use in

labour-based contracting. It would be very useful if the ILO would create a standard system and documentation that could be approved by the African Development Bank.

Two guide booklet would be required:

1. Appropriate contract procedures and administration, and
2. Unit rates

The guidelines should be developed for several categories of contractors such as petty contractors, transport contractors, routine maintenance contractors, etc.

The Institute of Civil Engineers may have useful information in their document **Conditions of Contract**.

The guidelines on small scale contractor development should refer to other existing documentation and how his can be used.

The Department of Feeder Roads in Ghana has recently updated its standard unit rates for tendering. Ghana, Kenya, Madagascar and Norconsult have relevant material that could provide basis information for a manual. Labour-based unit rates should be established on a national basis since productivities can vary a great deal from one country to another.

b) Mr Byrnes from Namibia informed the meeting about an experimental contractor training exercise which was arranged in the following way:

Contractors were invited to estimate for a specific job. The contractors were then trained in estimating and asked to produce an estimate based on unit rates provided by the ministry. The contractor which was closest to the correct estimate won the tender. This procedure had been tried with small scale contractors in South Africa. It is necessary that the government regulations allow the job not to be awarded to the lowest bid.

Mr Byrnes promised to provide more detailed information to ASIST.

Action Plan for Compaction

It is important to get feedback on Dr Kyulule's compaction research proposal.

ASIST staff visiting projects could provide project experts with a **questionnaire** in a standard format which asks about the **performance** of various types of **equipment** used by the project (Type, Use, Breakdown, Climate Conditions etc).

Information on dry compaction should be **collected**. The Ministry of Works in Namibia can provide some information.

Action Plan for Labour Standard

A copy of the proceedings will be sent to the International Labour Standards Department in Geneva (NORMES) for their information and comments. It was also proposed that NORMES should be requested to (i) produce general guidelines on the application of labour standards in technical cooperation and (ii) assist in the formulation of specific policy guidelines on the topics which were discussed during

the session on international labour standards. It was envisaged that this work should be done in close collaboration with the labour-based road programmes. To begin with, this would imply that personnel from NORMES should visit labour-based programmes and become familiar with such programmes.

Action Plan for TES

An Action Plan needs to be written to inform ASIST donors and collaborating ministries about the future programme of activities of the Technical Enquiry Service. This could be presented in the form of a brochure.

Two well done ASIST **technical journals** per year, each with a separate theme, should be sufficient to alert practitioners on the existence of Technical Service.

It was recommended that the journal would be indexed.

ASIST staff should be active in collecting and spreading information while visiting labour-based projects. It is also important that they discuss with the field staff what type of information is required.

APPENDIX 1

MINISTRY OF ROADS AND HIGHWAYS REGISTER OF CLASSIFIED ROAD & BRIDGE CONTRACTORS TOTAL NO. OF CLASSIFIED CONTRACTORS = 311

NUMBER OF CONTRACTORS BY CLASS A1 A2 A3 A4 B1 B2 B3 B4 C

4 11 35 40 4 11 90 151 41

CATEGORY A - ROADS, AIRPORTS & RELATED MINOR STRUCTURES

CATEGORY B - BRIDGES, CULVERTS & OTHER STRUCTURES

CATEGORY C- LABOUR-BASED ROADS WORKS

APPENDIX 2

STANDARD SET OF EQUIPMENT
1 Tipper Truck
3 Tractors
6 Trailers
2 Pedestrian Vibrating Rollers
1 Towed Water Tanker
1 Water Pump
1 Chainsaw
1 Set of Handtools
1 4WD Pick up Vehicle (recent addition)

II. ASPECTS AND BACKGROUND OR LABOUR-BASED CONTRACTING - THE GHANA EXPERIENCE

Presented by Peter Bentall COWI Consult, Harare, Zimbabwe

1. Warning - Danger of making a blanket policy (e.g.) Change force account to private sector without studying all the local implications.
2. Ghana Project Environment

(i) New, separate feeder Roads Department

(ii) Crisis situation 20 000 plus km of roads - all poor.

(iii) Cocoa a key export crop - urgent action needed.

(iv) Expensive and poorly performing equipment-based private sector - inappropriate for rural,

low-volume roads. Contractors were dictating.

(v) Almost total absence of middle management i.e. contractor supervision inadequate. 2 senior engineers only in DFR head office.

(vi) No other donor/aided project for distraction

(vii) Total/unqualified commitment/enthusiasm/energy of the Director and calibre/continuity of counterparts.

(viii) Existence of large number of small/locally based contractors.

3. Planning/Preparation

(i) Component of World Bank 4th Highway. Economic Study.

(ii) Comprehensive (to understate) project document - 242 individual activities!!

(iii) Prior appointment of counterparts.

(iv) Pre-project study tours.

(v) Preparatory road inventory work undertaken.

(vi) Pre-project contractor seminars.

(vii) Equal emphasis on SIAM (maintenance component).

4. Practical Arrangement/Problems

(i) Procurement of equipment - ICB procedure

(ii) Involvement of BHC.

(iii) Civil service procedures.

a) bank accounts

b) payments/casual employment

c) tasks/incentives/bonus

(iv) Remoteness of sites/communication.

(v) Uncertainty of Government funding (e.g. Road Fund)

(vi) Model/trial/Standard contracts equipment situation - foresight? Expansion outstipped availability.

(vii) pressure for expansion uncontrolled.

(viii) pressure for expansion uncontrolled.

(ix) Resistance to introduction of competitive bidding requirement.

PRIVATE SECTOR INVOLVEMENT - SOME ASPECTS (General)

1. Involve those not engaged in major equipment-based project, e.g. benefit from funded inputs.

2. Small local organisations has no other distractions.

3. Offer a long-term vision to encourage active participation.

4. Assume that all those selected/trained will perform. Avoid discouragement and discontinuity.

5. Emphasize organisation and management at site level - supervisors are the key.

6. Competitive bidding is not an immediate objective - workload will be significantly in excess of contraction capacity for several years.

7. Ensure rates and contract conditions result in a healthy profit and also that financial costs are comparable with equipment-based works.

8. Communicate with and advise the contractors themselves - it is in the interest of all parties to get a satisfactory result.

9. Experience indicates that even some of the least likely looking small contractors can be most successful, but some engineering expertise is extremely useful.
10. New and appropriate equipment and tools should be available. Do not allow the contractor to start off at a disadvantage.
11. Get involved in the contractors' financial arrangement e.g. bank loans. Small people do not have the experience to stand up to the devious ways of the banking world.
12. Do not underestimate the length of training period involved both for contractors' staff and, equally important, the client's supervision and contract administration staff.
13. Simplified contract documentation is needed since generally small contractors have little or no experience of contract administration.
14. Prompt payment is essential since a large part of this will be directly due to the labour force without whom his operation will collapse.
15. Include essential mechanical backup as a service/training element. Work is inevitably in remote areas.

DISCUSSION

Choice of Technology

The labour-based small scale contractors programme in Ghana has proven to be highly successful. Roads constructed using labour-based methods are less costly than roads constructed to the same standards using equipment-intensive technology. The Government of Ghana has therefore decided to continue the training of additional small scale contractors and to expand the programme to cover all regions of Ghana.

The percentage of road works carried out using labour-based methods is growing. In the short to medium term labour-based contractors should be able to compete with equipment-based firms for larger scale feeder road projects. In the long term the objective would be that all contractors are able to choose and apply the most appropriate technology according to the circumstances.

Donor Funding

The future of the programme is carefully taken into consideration when planning the training programme for new small scale contractors. It is essential that funds are secured for road works so that the trained contractors can be provided with a sufficient and steady supply of work. This is the more necessary because most small firms have had to conclude loans with local banks to acquire sets of light equipment. So far, this has been well planned in Ghana. However, there is a tendency of donors to sponsor the foreign exchange requirement components of development projects. On labour-based projects this component is small and therefore such projects may be less attractive to governments aiming to maximize the donor contributions. It is important that funding agencies adjust their policies to take account of this problem.

In the future the Ghana programme will be gradually redirected from rehabilitation works to focus more on the maintenance demands of the road network.

Training of Contractors

When selecting contractors for training, preference is given to companies where the owner performs the

duties of both the managing director and the site manager, in other works, companies with very little overheads and motivated owners. Among this group, candidates with relevant technical qualifications will be ranked highest.

Each contractor sponsors four members of his staff for training. It is expected that the contractor will sustain his staff during the training period. Training of additional foremen are to be paid for by the contractor.

The training courses are arranged for both contractors and the DFR staff. DFR has lost some of its supervisors who preferred to work for the contractors.

Payment Procedures

The estimates are prepared by the resident engineer. Initially, interim certificates were awarded on a monthly basis and payment made based on measurement of executed works and established unit rates. After labour advances, materials supplied and cost of equipment had been deducted, the balance was paid to contractors after the Interim Payment Certificate had been endorsed by District and Regional Administrations.

Although 80 % of the contractors preferred this system, it places a significant burden on the project management. Today the contractors are advanced 15 % of the contract value at the beginning of the contract to cover labour and materials inputs, thus the contractor becoming more independent.

The streamlining of administrative procedures and ensuring prompt payment has contributed significantly to the success of the programme. It is evident that a small contractor cannot advance large sums for labour-wages which represent his largest payment obligation closely followed by the monthly repayments of the equipment loans. To ensure that the contractor can meet these obligations on time it is crucial that the payment procedures are on time and as decentralised as possible.

Currently the payment procedures in Ghana are centralised. However, this is expected to be changed when sufficient management and administrative staff have been posted in the regions.

Banking

The light equipment issued to the contractors is procured by the Bank of Housing and Construction (BHC) with the bank providing a loan to the contractor which is to be repaid over a 4 year period. The loans are evaluated in US dollar terms at a fixed interest rate of 20 %. Monthly repayments are made in local currency at the prevailing exchange rate.

These conditions are very advantageous to the bank but place a heavy burden on the contractors. DFR is examining the possibility of financing the equipment component on this type of programmes through facilities provided by the African Development Bank. For the newly trained firms (22), DFR will also explore the feasibility of obtaining more favourable terms by inviting other local banks to bid for the services to be provided.

Payment of Labour

The payment of the casual labour is based on a task work system. Although task work may not be optimal in the long term for contracting, (piece work is likely to be more appropriate), it greatly facilitates the planning and monitoring of the works for the contractors. At later stage the contractors will

be at liberty to choose and apply their own incentive scheme since they will be paid on the basis of the unit rates.

The bonus system rewarding regular attendance through additional payments was introduced in an early stage as an incentive to avoid absenteeism. In case of absenteeism of a worker due to illness, ceremonial duties, etc., the worker may organize his replacement so as not to lose his bonus. Attendance is checked by DFR. A experienced workforce with regular attendance tends to perform better than a workforce whose labourers are being changed frequently. To implement the bonus system a civil service regulation had to be waved.

In Kenya the bonus system was not considered to be necessary since there is a very high surplus of labour directly available to replace absent labourers.

Equipment

Even on labour-based projects with a relatively small amount of equipment the mechanical maintenance support is critical to the progress of work. A training programme for the contractors mechanics is provided to ensure that the contractor is capable of performing preventive and routine mechanical maintenance on his equipment. During the first trial contract the DFR also provides mechanical back-up services to the contractors. The costs of these services are paid by the contractors but in the agreement it is clearly stated that the DFR is not responsible for the machines. The risk of construction delays due to serious breakdowns, however, is assumed by the project. In case of service delays the contractor can claim a price reduction.

Some contractors may in the future increase the type and number of the equipment. Rollers will become heavier. The light pedestrian roller which has been used so far has had too many breakdowns and the DFR requirement for compaction is 98 %. One contractor has already procured a heavier 1.2 ton roller.

Since the hauling distance for gravel has so far seldomly exceeded 4 km, the contractors are likely to continue using the tractor/trailer combinations.

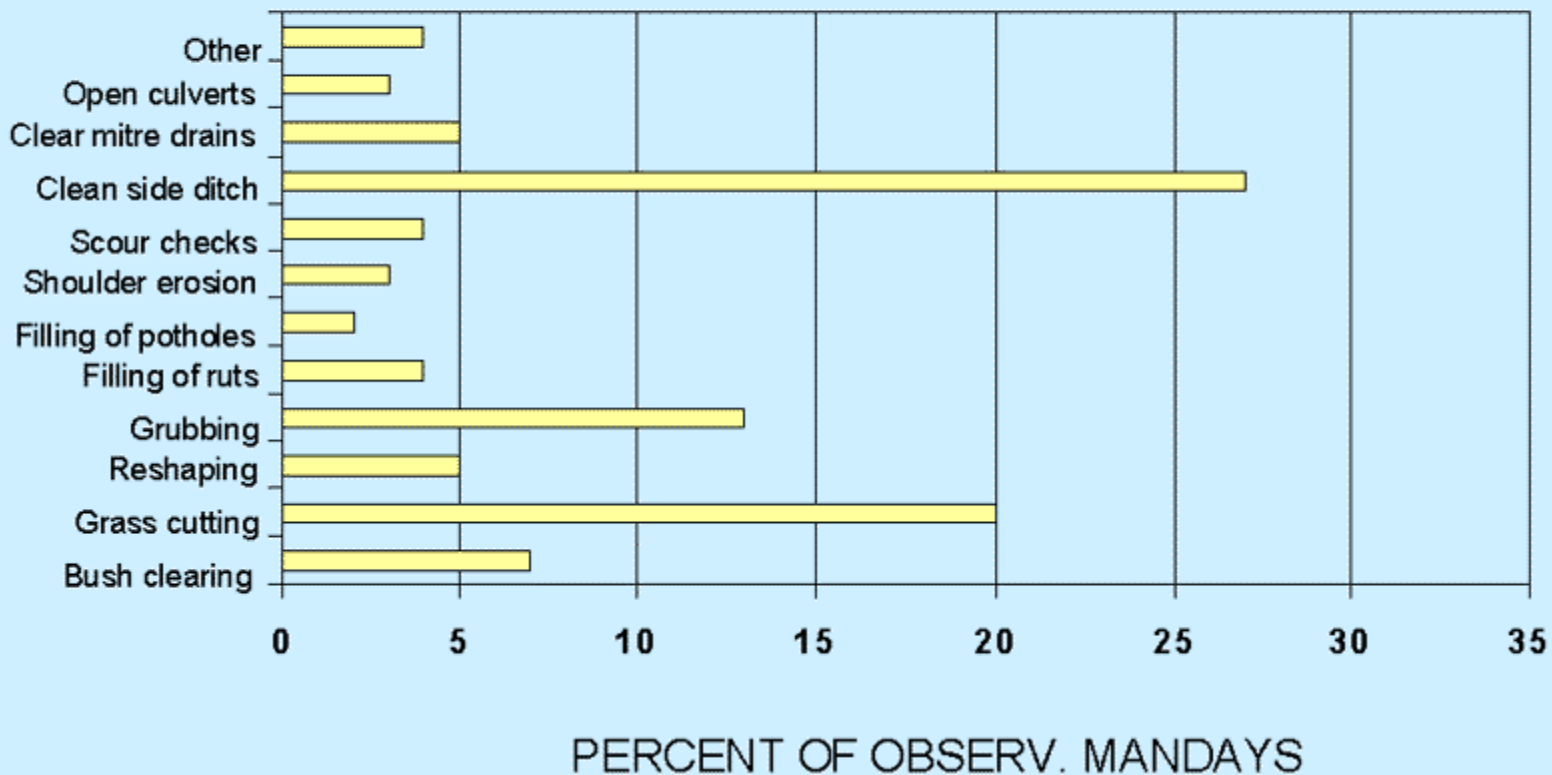
Drainage Structures

The labour-based programme in Ghana is located in high rainfall areas with usually only two dry months during the year. Rivers and streams in this region have a relatively constant flow of water throughout the year. Due to this, the locally designed concrete box culvert is the most commonly used drainage structure. However, when the programme is expanded to other regions such as northern Ghana where flushes are more common, drifts will be introduced.

Observed routine maintenance work carried out on 15 roads

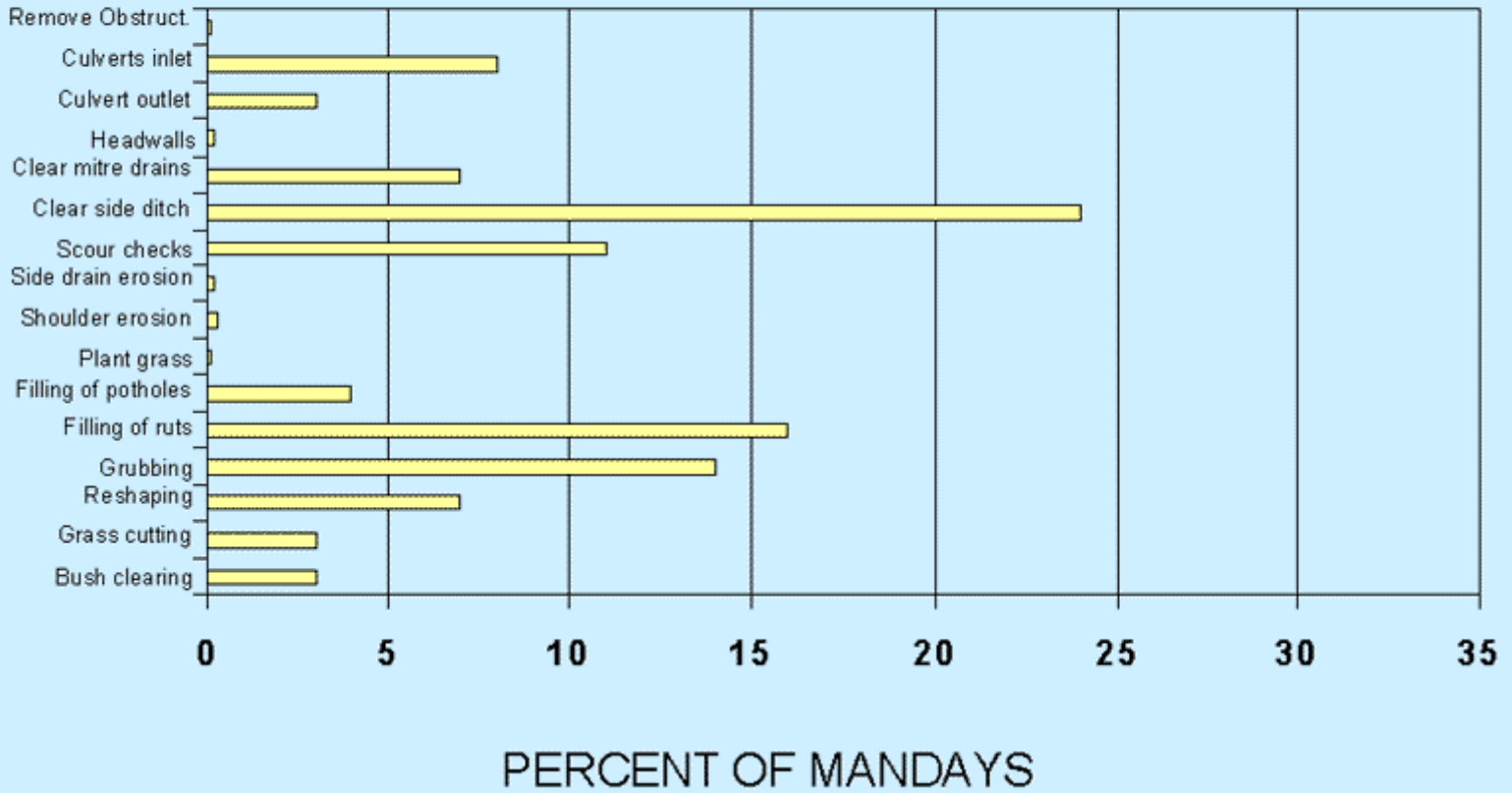
DISTRIBUTION OF ROUT.MAINT. ACTIVITIES

Observed Routine Maintenance
Work Carried Out on 15 Roads



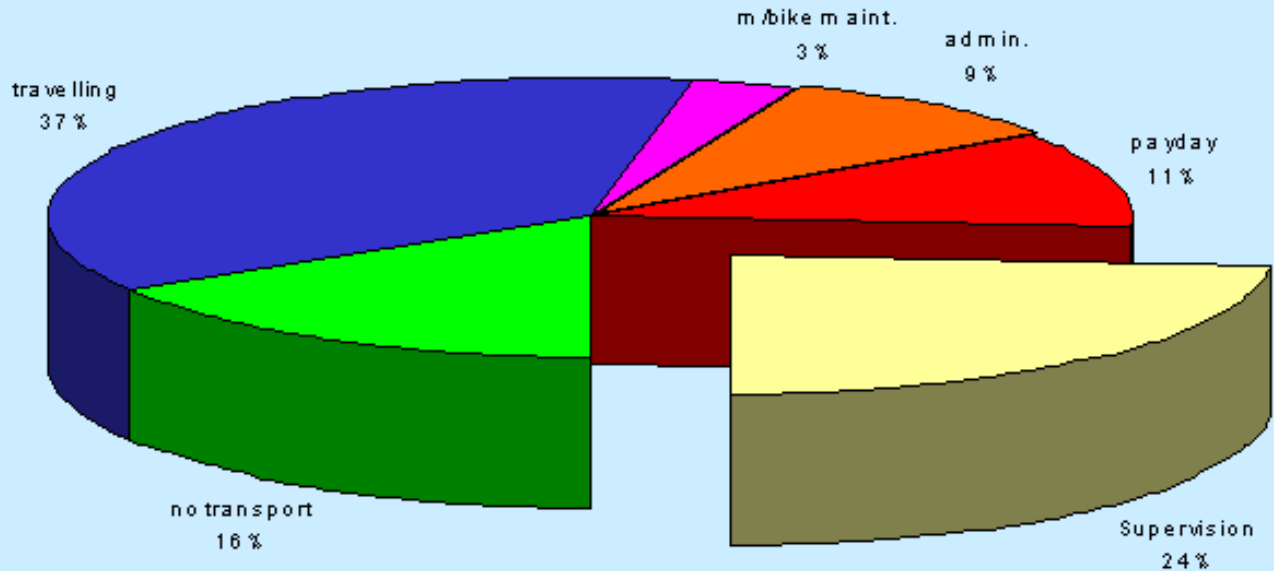
Routine maintenance work carried out on 50 roads sections

Routine Maintenance Work Carried Out on 50 Roads Sections



How a routine maintenance overseer spends his time

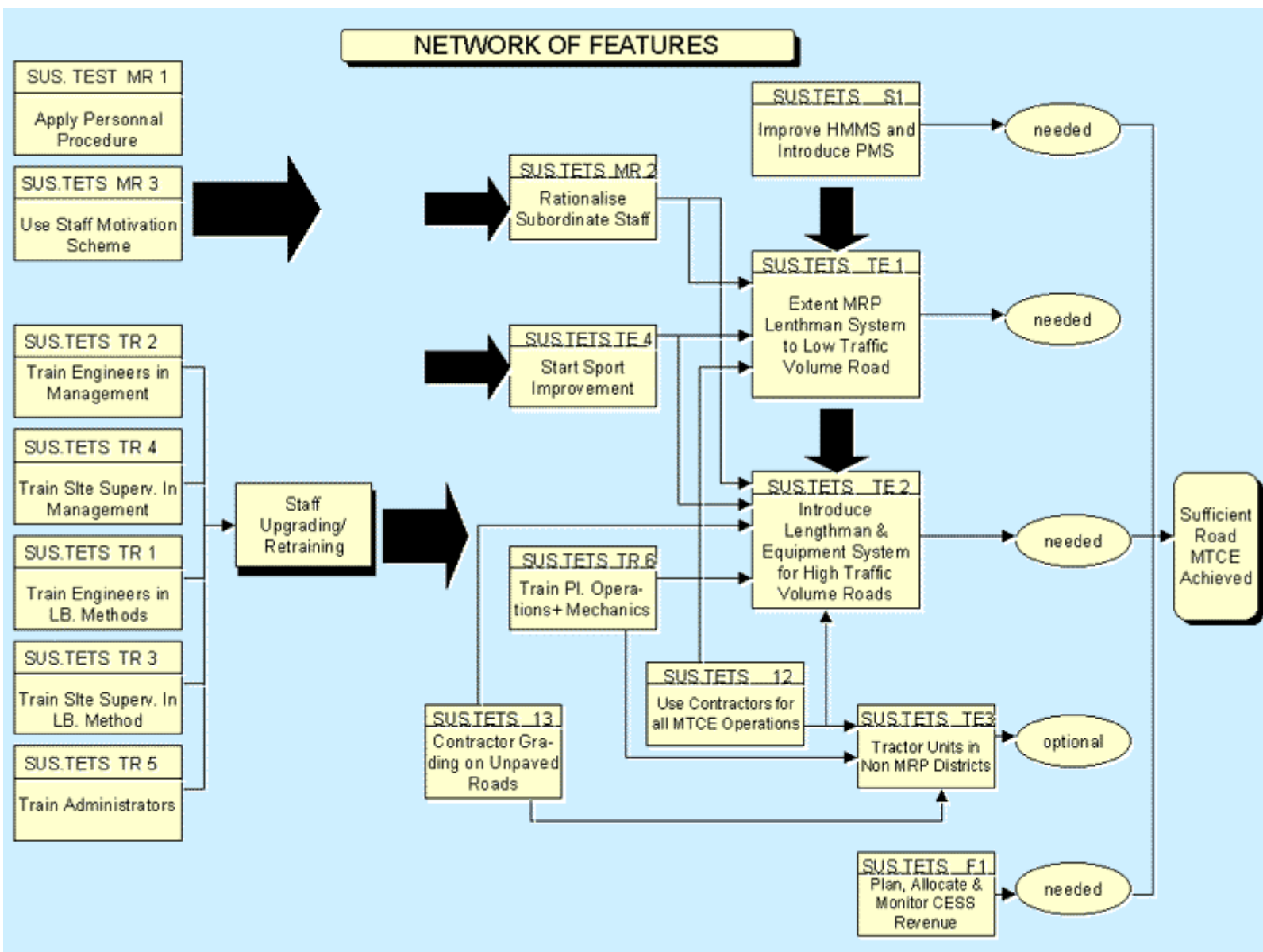
HOW A ROUTINE MAINTENANCE OVERSEER SPENDS HIS TIME



Overseer's Supervision Time Per Lengthman

Av. Working days per month	19
Supervision time @ 24% (hrs)	36.5
Av. No. of lengthmen per overseer	128
No. of visits per month	2
<u>Time per visit (mins)</u>	<u>9</u>

Compaction test results for labour based gravel roads in Ghana



COMPACTION TEST RESULTS FOR LABOUR-BASED GRAVEL ROADS IN GHANA

