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## **Report I**

# **Addressing Maintenance Effectiveness**

# Appropriate and Efficient Maintenance of Low Cost Rural Roads

## Report I Addressing Maintenance Effectiveness

February 2000

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## EXECUTIVE SUMMARY

To address the goal of “Appropriate and Efficient Maintenance of Low Cost Rural Roads in Developing Countries” Element A of this research has been an investigation into maintenance issues. The research focuses on constraints to maintenance, which currently result in inefficient and inappropriate maintenance regimes and on technical aids to maintenance in the form of manuals.

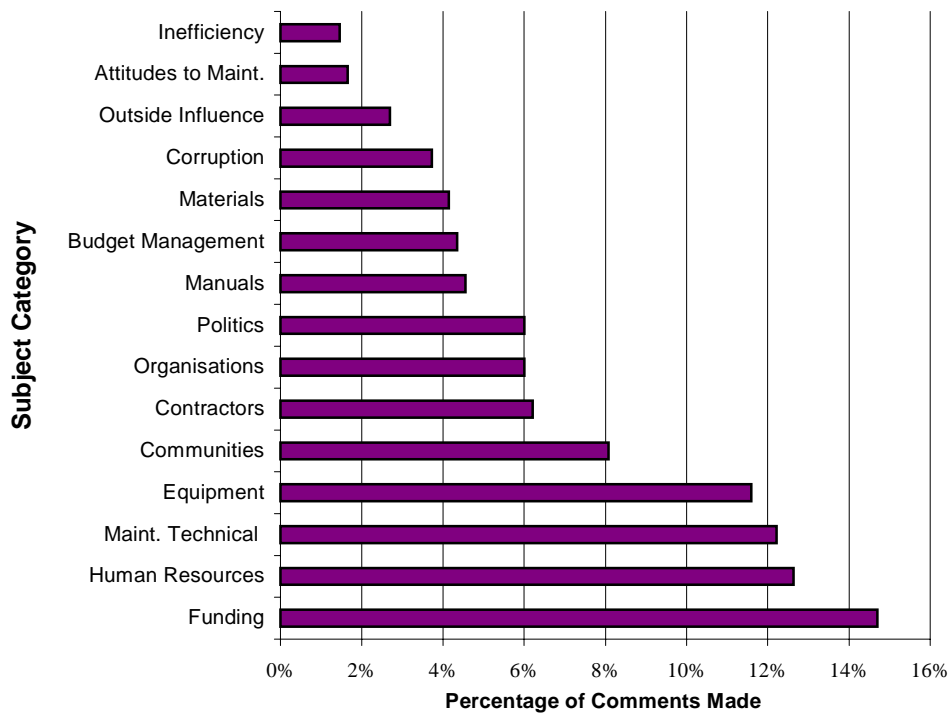
Unlike previous work in this area, the research has been conducted in a qualitative rather than quantitative manner. The research has sought to help clarify a complicated, dynamic and inter-related problem environment using an established Operations Research methodology, and thereby provide insight and suggest approaches that may prove the source of more sympathetic, innovative and sustainable solutions to rural road maintenance. The research explored the unstructured perceptions of a range of practitioners to identify those issues that raised most “anxiety”, and analysed these issues and the manner in which they were raised.

The research was undertaken by conducting a literary review of existing documents, and a series of unstructured interviews with a group of 100 people considered to be practitioners and possibly “experts” in this field. Interviewees included high, medium and low level professionals from five developing countries and a number of expatriate consultants. Data gathered from these interviews was then analysed to investigate its inherent structure and content along with an analysis of the overall nature of issues raised.

Interview data was analysed using the SODA (Strategic Options & Analysis) methodology, and Cognitive Mapping in particular. This methodology enables a range of perceptions to be collated into a single group perception of a problem that may require a portfolio of actions rather than a single solution. This approach allowed subjective ideas from a range of cultures and environments to be captured into a cohesive and understandable whole, and has resulted in a description of the problem environment that was reached through consensus and full participation.

Using more traditional quantitative analysis techniques on the interview data, initial analysis of the subjects raised by interviewees tended to support traditional rankings of key issues constraining the sector. As expected these are funding, human resources, technical issues and equipment in descending order of importance as shown below in Figure ES1.

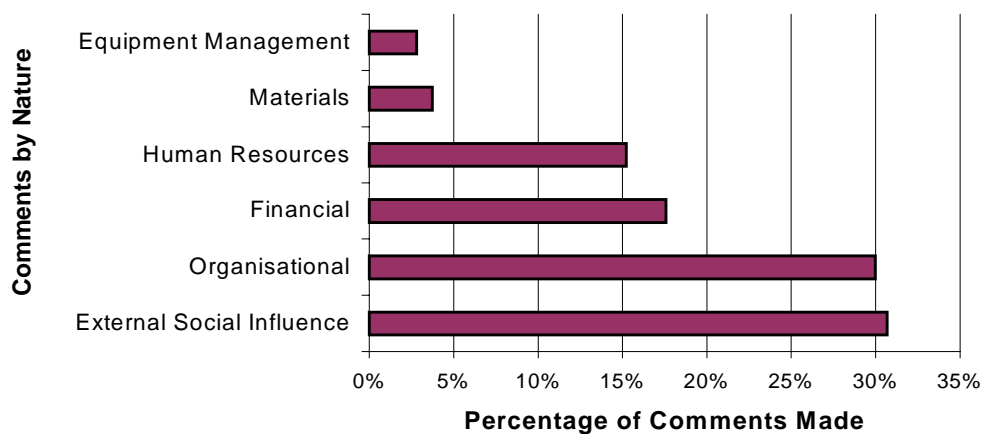
**Figure ES1 - Interview Subject Analysis**



However using SODA and cognitive mapping it was possible to objectively identify 9 issue areas that could be addressed in comparative isolation, and more importantly identify trends and nuances that resulted from the cultural and social dimensions of the problem.

This social aspect of the analysis reveals that external social influences and organisational influences dominate the key issues raised as shown in Figure ES2.

**Figure ES2 – Interview Analysis by Nature of Comments**



This implies that appropriate and efficient solutions can only be found by first understanding the social and organisational environment, and then fully incorporating them into the development process. The research strongly suggests that there is no generic solution the problem, but that bespoke maintenance regimes will have to be developed for each specific social and organisational environment. The research also suggests that indigenous solutions should be allowed to evolve from the bottom-up, but must be complimented by first developing appropriate enabling environments of good governance and stakeholder participation.

Overall the approach has shown that there is a need to adopt improved methods of research, planning, management, monitoring and evaluation that fully incorporates the social dimension of the road sectors impact environment. This will be new to engineers. A number of established techniques and methodologies are available from other sectors and disciplines, but further work is required to collate and assess these, and produce suitable practical tools for practitioners in the field.

The following report for Element A covers two issues in detail, Report 1 addresses constraints to maintenance, and Report 2 reports is an assessment of maintenance manuals and includes a short guide on what to consider when preparing a manual.





# REPORT I – ADDRESSING MAINTENANCE EFFECTIVENESS

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## REPORT 1 ADDRESSING MAINTENANCE EFFECTIVENESS

### 1. INTRODUCTION

The DFID funded project “Appropriate and Efficient Maintenance of Low Cost Rural Roads in Developing Countries” is a series of reviews and research with recommendations for improving the maintenance of low cost roads. Element A of the project set out to review procedures, standards and methods with the aim of producing a maintenance manual more relevant to the needs of low cost roads.

It has long been recognised that the maintenance of low cost roads has been inadequate, but the cause is less well defined. Jones (1983) argued that *‘the problem of maintenance is not just that of low productivity due to lack of funds, but is usually a combination of inefficient management, inappropriate plant and techniques that will not necessarily improve if more funds are made available.....better usage of whatever resources and fund-share available.....is required’*<sup>1</sup>.

In order to achieve this common goal, it was believed that it was necessary to first understand the “problem” environment and so achieve some sort of consensus as to what the problems were and what their causes may be. Once this had been achieved, a process of distillation and analysis was to be used to systematically identify common features that cause ineffective maintenance of low cost roads. These features would then be reviewed in the hope of providing policy makers and donors with a structured and systematic insight into the problem as a whole and a set of guidelines covering “key underlying issues” that should be addressed in future efforts to improve maintenance of low cost roads.

The planned approach to the project was to conduct a literature review and then assemble data on current practice by using questionnaires and direct interviews with maintenance engineers and field workers. The original hypothesis was based on the assumption that existing standards and procedures could inhibit effective maintenance by being too inflexible or inappropriate for low cost roads.

As the project proceeded two issues arose. The first was the planned publication of a new Overseas Road Note by TRL, which would relate in part to low cost roads. From discussions with TRL it was evident that the new OSRN would give more emphasis to accessibility and appropriateness than engineering standards. It was agreed that another manual would not be appropriate. Further information on a holistic structuring the complex problem environment relating to low cost roads, and the identification of some the constraints that may inhibit the implementation of new guidelines would however compliment the work of TRL.

The second issue was one of methodology. To gain maximum benefit for current knowledge on the subject, the project was designed to draw from both existing literature and the pooled experiences and understandings of practitioners in the field. Time and resource constraints precluded gathering together a comprehensive body of “experts”, to pool experience and understanding and together structure and analyse the problem. As a result researchers have had to collect this experience and understanding from many sources and then collate the material to conduct analysis in isolation.

Recent research at the University of Birmingham (and elsewhere) challenged the traditional use of questionnaires as a means of evaluating complex problems. The methodology was therefor modified to use more recent holistic Management Science techniques to structure and analyse this complex problem that has a high sociological dimension and no single “right” answer.

The research has differed significantly from previous work, in that it has not assessed the issue of maintenance through the quantitative analysis of hard factual data, but rather has explored the unstructured perceptions of a range of practitioners to identify those issues that raise most “anxiety”. If previous quantitative research, and their resultant recommendations and manuals are correct in their identification and analysis of key issues, this research

should be supportive of previous work. Significant differences may indicate that existing material may need to be reviewed in context of the social dimensions of maintenance of low cost rural roads.

This report raises issues revealed from this analysis, and establishes a set of “key issue areas” that policy makers and donors may wish to consider when developing new strategies and alternative approaches to the maintenance of low cost roads. These “key issue areas” predominantly cover social and organisational aspects rather than technology and methodology aspects covered by TRL.

## 2. THE PROBLEM ENVIRONMENT

Poor performance in the maintenance and management of low cost roads has been reviewed and assessed by many in recent years and is now well documented. Yet the problem persists. The questions raised are a mix of normative and factual ones: *who should* maintain them? *who can* maintain them? to *what* standard? *what* resources are necessary and *what* methods are appropriate to achieve these standards?

To begin to address these questions, it is first important to understand the complex environment in which they exist, and then address the issues specific to that environment.

With respect to the problem of effective maintenance of low cost rural roads, the worst cases can be said to occur in countries where, some if not all the following conditions occur:

- a shortage of financial resources
- a high dependence on external sourced of capital for public expenditure
- a high significance of capital investment projects as a portion of total public expenditure
- a large portion of the population living in absolute poverty
- a wide diversity of ethnic groups within the population
- a large cultural and communications gap between decision makers and those affected by the decisions
- a greater importance of “political” factors in the making of decisions
- a dominance of central planning
- a shortage of current, reliable and appropriate information available to decision makers
- uncertainty in the planning environment, both internal and external
- a shortage of skilled supervisors and managers
- low levels of empowerment afforded to the rural and more disadvantaged communities
- inadequate levels of capital (human, natural, financial, physical, and social) available to indigenous communities.

At best the problem environment can be described as;

- complex
- dynamic
- “hard” and “soft” (containing both technical and social dimensions)
- relative (depending on the country/region in question)
- subjective (depending of the perspective of the individual)
- non-generic, and
- multi-levelled

This evolved complexity has made it extremely difficult, for both researchers and “experts”, to structure the problem environment, and thereby clarify problem areas requiring attention and enable structured dialogue to address specific issues. An approach to problem structuring which uses the local knowledge available, which can be characterised by the participation of all interested parties in a language and format that mirrors the practitioners thought process, goes a long way to a more efficient use of already available resources.



### 3. PROJECT RESEARCH METHODOLOGY

#### 3.1 Strategic Options & Analysis (SODA) and Cognitive Mapping

Strategic Options Development and Analysis (SODA) is a method by which these aims can be achieved. It is an approach by which the researcher acts as a facilitator to structure the problem by a process of participative modelling. These are generally problems that demand an ability to use model building to help with both quantitative and qualitative aspects of the problem. Its goal in this case is to informally gather together the objective and subjective knowledge of dispersed individuals and organisations, and then pool this knowledge to form a collective understanding that can be recognised by all, but not reflect a single situation or perception.

The SODA method is particularly suited to situations in which a portfolio of actions, rather than a single solution, is required to solve the problem situation. The method is designed for use in situations where there is a "team" of individuals, each with appropriate involvement and expertise in the problem situation, but with a significantly different orientation within the organisation or problem situation. It uses a modelling technique; cognitive mapping, that is comparatively simple and consequently easy to understand, which in itself helps organise thinking, rather than suggest a course of action. It is partially these attributes that make the approach so suitable for use in developing countries.

SODA is a method by which complex problems can be clarified, using cognitive mapping as a technique, to model the problems, which are then analysed for content and structure, within a social setting. The framework around which the approach was developed comprises of four important and interacting theoretical perspectives; each coincidentally with important positive implications to third world developmental environments. The four perspectives, about the INDIVIDUAL, about the NATURE OF ORGANISATIONS, about CONSULTING PRACTICE, and about the role of TECHNOLOGY AND TECHNIQUE, are brought together to form the core notion that drives SODA. That is its application as a facilitative device.

The SODA approach is founded on 'subjectivism'; an appreciation that every individual will have his or her own personal subjective view (or model) of the 'real' problem and what brought it about. The individual's perceptions of his or her environment are combined to produce a person's internal model of reality. This model can be described as incomplete, problematic, poorly articulated and subjective, and therefore produces a distorted view of reality. Yet it is this internal model that the individual acts upon. The internal model is further distorted when an individual attempts to build a model based upon the internal model of another. The SODA approach therefore attempts to construct an enhanced external (or hard) model, built upon the perceptions of participating individuals. The process of model building enhances the participants' internal models by better articulation through dialogue, and a more comprehensive model by the addition of alternative view points, and can therefore be said to be more acceptable and satisfactory. Enhanced external (team) models can therefore be regarded as a better basis for; discussing strategy, taking co-ordinated action, proceeding with confidence, and further model building with specialised, as the process in which it was developed will have created a common way of constructing future events amongst the team members.

The SODA approach uses therefore, and develops, each participant's subjective view of the problem to illuminate the problem situation; and then through the modelling process rationalise the groups' individual perspectives into a single cohesive representation of the problem, with which all participants can identify. The wisdom and experience of the team members is the key element in developing decisions with which the participants are confident. Teams are deliberately created so that each member will bring a different perspective to an issue, born from their different role in the organisation, and consequent experiences and wisdom. In the SODA approach these differences are exploited beneficially, to produce the richest possible representation of the problem. However this deliberate act of encouraging richness in problem construction does accentuate the complexity within the problem, and thus reduce tractability.



Within SODA, the construct theory has particular significance because cognitive mapping; - the technology and technique of the approach, uses language as its basic tool. Language is seen as a significant improvement over the use of figures and symbols in problem structuring and problem solving. This is because it is the common currency of organisational life. It is the everyday form of communication and thought, and therefore is a form of expression with which all participants will be familiar. Mathematical figures and symbols require personal interpretation; an activity which in itself may introduce divergent understanding of the situation. The 'cognitive map' in this approach is a model of the 'system of concepts' used by the client to communicate the nature of the problem.

This aspect of language, as a common form of communication, can have added significance in developing countries. Developing nations are often comprised of a large variety of religious, tribal, ethnic and social groups, sometimes only united by an 'official' language. A method therefore, by which ideas and perceptions can be communicated in a means understood by all, becomes all the more important.

Within organisations world wide, internal politics are a fact of daily life. This fact must be accepted if the individual is to understand the processes motivating organisational life. Politics however in the developing countries often can be seen to be far more pervasive, as not only are internal organisational issues at stake; but also conflicts arising from diverse ethnic considerations. These diverse ethnic issues are often of national dimensions, and take place at all levels of private and public life. The use of politics as a means of problem solving, is almost second nature to many a third world national; where lobbying, coalitions and personal rivalry that makes up political life, are the norms. SODA, one of the few problem structuring methods that specifically uses the existence of politics, and resulting negotiation as part of its process, can be seen once again to be suited to third world use. Approaches requiring a more neutral and subjective framework, are by their very nature, often misunderstood, and therefore less likely to achieve their potential, under these third world conditions.

The final perspective in the SODA approach is cognitive mapping the technique, and the resultant analysis undertaken in this research.

### 3.2 Data Gathering - Interviews and Questionnaires

Semi-structured interviews were used to obtain information, rather than rely on questionnaires. When asking questions of a sensitive nature, respondents can be reluctant to write down their thoughts for fear of reprisal. Interviews which promise confidentiality can be more successful at obtaining such information. Questionnaires have their uses, for example to find out how many people hold a particular view, or what number of roads are in the network etc. *'In the past, much attention has been given to describing, coding and counting events, often at the expense of understanding why things are happening. This has led to a predominance of quantitative research methods which are geared, for example, to finding out how many people hold particular views.'*<sup>1,2</sup>

In this case, the aim was to ascertain from experts what their perceptions and experiences were with regard to maintenance, and this has indeed been done quite successfully. Experts were asked what they felt were the real constraints to maintenance, and many gave frank and candid answers. Any observations and comments given by the respondents are perfectly valid, because the people working in the organisation are the people who are qualified to comment. *'the open-ended approaches allow the subject ample opportunity to comment, to explain, and to share experiences and attitudes opposed to the structured and directive interview that is dominated by the interviewer.'*<sup>3</sup>

### 3.3 Elite Interviews

Interviews can be carried out with anyone willing to talk. In this case, 'experts' were sought, and the definition of an expert in this context, is anyone involved in maintenance, or who has been involved in maintenance, or has had experience of working in a developing country. Interviews with experts can also be described as 'elite interviews, the following quote explains: *'Elites in general resent the restrictions placed on them by narrow, stereotypical*

questions. They desire a more active interplay with the interviewer. In the course of the elite interview, considerable variation will occur in the degree of control, with the respondent occasionally assuming the questioner's role. Elites respond well to inquiries related to broad areas of content and to a high proportion of intelligent, provocative, open-ended questions that allow them the freedom to use their knowledge and imagination. In working with elites, great demands are placed on the ability of the interviewer, who must establish competence by displaying a thorough knowledge of the topic or, lacking such knowledge, by projecting an accurate conceptualisation of the problem through shrewd questioning. However, the interviewer's hard work usually pays off in the quality of the information obtained. Elites often contribute insight and meaning to the interview process because they are intelligent and quick-thinking people, at home in the realm of ideas, policies, and generalisations'.<sup>4</sup>

#### **Elite interviewing has a number of advantages and disadvantages:**

The **advantages**: valuable information can be gathered due to the positions they hold. They can provide an overall view of an organisation. They are likely to be familiar with policies and past histories.

The **disadvantages**: accessibility to elites is difficult, because they are busy people. They can be difficult to reach. The process of interviewing must be modified to suit the person.

There were a number of methods that could have been adopted for interviewing people. A set list of questions could have been used, with each person being asked the same question in turn. Selected people could have been sent away with a questionnaire to fill in. However, experts may feel that different problems are significant in their situation, and a questionnaire can therefore act as a severe restraint to the respondent. '*...traditional individual interview, which used a predetermined questionnaire with closed-ended response choices, had a major disadvantage: the respondent was limited by the choices offered and, therefore, the findings could be unintentionally influenced by the interviewer by oversight or omission*'.<sup>5</sup> In an elite interview, all that is required is to start the 'ball rolling' and then prompt when necessary on particular areas of interest.

The expert knows what the problems are, all that is needed is to give them an insight into what type of information is required and they can then tell the interviewer what they think is important. Candid and forthright interviews are offered as a demonstration of the interesting information which can be gathered.

### **3.4 The Interviews Undertaken as Part of the Research**

Access to people was achieved using the following methods:

1. Access to people in maintenance organisations through Roughton International
2. Access to people through contacts
3. Access through past students
4. Access through the Rural Transport Development mailing list

Interviews were carried out using the following checklist of topic areas.

#### **Organisational structure:**

- Type of structure
- Size of network
- Hierarchy and definition of network
- Staff - Number, type, training
- Vehicles - Centralised equipment, spare parts etc.
- What manuals are regularly used, and are any developed in house?
- Are the Road Maintenance Management guidelines actually used?
- Is an MMS used

**Finance:**

- Examples of budget bids and allocations
- Examples of how the budget is split
- Examples of allocation to local authority (district)
- Examples of allocation to community groups

**Maintenance:**

- Which roads does each organisation maintain?
- How is performance of the roads measured?
- What is the basis for the allocation of resources?
- Is there any political influence?
- Have there been any successful / unsuccessful projects implemented by consultants?
- Are contractors used for routine and periodic maintenance?
- Are standards used - examples
- How is work prioritised

**Accessibility:**

- How is it defined and how is it measured? Examples?
- Do rural communities participate in maintenance & construction?
- Have there been any successes with regard to community maintenance?
- Are there standards for rural roads, (what is the definition of a rural road)

**3.5 Countries and Confidentiality**

The issues discussed with people and the delicate nature of many of the factors mentioned mean that names will not be used in the report, the countries will generally be referred to using a code letter where the subject matter is thought to be of a sensitive nature.

*'The differences between the optimum frequencies and the different cases are significant and due to the analyses being carried out for different material types, roughness levels, climate, traffic categories and unit costs. This illustrates the problem of applying conclusions drawn in one country to conditions in another country or even to a different road in the same country'.<sup>6</sup>*

Investigations in a number of countries, supplemented with additional information has allowed the overall framework in which maintenance takes place to be established.

**3.6 Interviewee Profiles****Table 3-1 Interviewee Matrix**

	Malawi	Nepal	Uganda	Belize	Fiji	Int.	Total	
Expatriate	1	4	1	4	1	26	37	37%
High Level	5	2	3	2	0	25	37	37%
Medium Level	4	4	9	4	3	0	24	24%
Low Level	1	0	2	0	0	0	3	3%
Total	11	10	15	10	4	51	101	
	11%	10%	15%	10%	4%	50%		

Interviews were undertaken in a number of developing countries, and also in the UK with overseas consultants. The types of people spoken to have been split into 4 levels, for ease of reference, as follows:

**Table 3-2 List of Experts**

Level of Experts	Description
High Level	Staff working within organisation, generally in developing countries, although not all. Staff such as Director of Roads, Commissioners etc., City Engineers.
Medium Level	Staff working within organisation in developing countries. Such as District Engineers and Municipal Engineers.
Low Level	Staff working within organisations in developing countries. Such as Road Supervisors, Foreman, Road Inspectors.
Expatriate	Staff working for overseas consultants, who are not a native of the country they are working in. This group generally included people from UK, Australia and New Zealand. Also staff working for donor organisations.

### 3.7 Interview Data

To structure and collate the detailed data gathered, interviews were transcribed into a summary format, and then the contents of each interview was segregated into clearly apparent "subjects categories". These summary transcriptions are produced in Appendix to Report 1 (A) – Interviews.

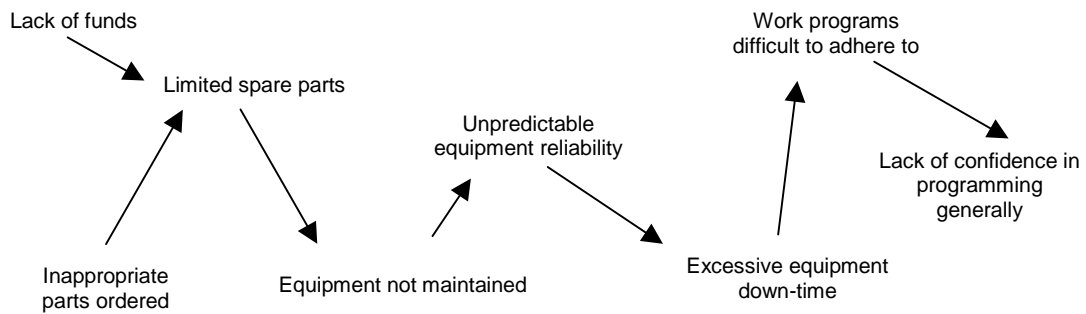
The appendix is ordered by "Subject Category" and provides a summary of interviewee's perceptions and anxieties for different aspects of each category. The resultant insight and information gathered from existing works and research has also been collated into the given "Subject Categories" and is shown where pertinent in each category.

The substance of each category was then further precised into a set of concepts and causal links that described the essence of the issues raised under each subject category. To assist further analysis the number and status of contributors to each concept was also recorded. This enabled resultant analysis to ascribe prevalence (number of times an issue was raised) and organisational/cultural relevance (the organisational/social status of those that raised the issue). These aspects were useful to establish notional spheres of influence and distribution patterns of concern.

### 3.8 Cognitive Mapping

Cognitive Mapping is the label given for the general task of mapping a person or groups cognition's within a field of psychological research on perception. The SODA-based version of cognitive mapping, as a modelling system, is founded on the belief that language is the basic currency of organisational problem solving. In this respect therefore a cognitive map is a model designed to represent the way in which a person or group define an issue. It is a network of ideas linked by arrows; the network is coded from what a person says. The arrows indicate the way in which one idea may lead to, or have implications for, another. Thus a map is a network of nodes and links that portray an understanding of a situation and a series of "strands of reasoning".

In this case the precised information gathered from the interviews forms the nodes of the map and links are derived from the flow of its content and impact / influence on other nodes.

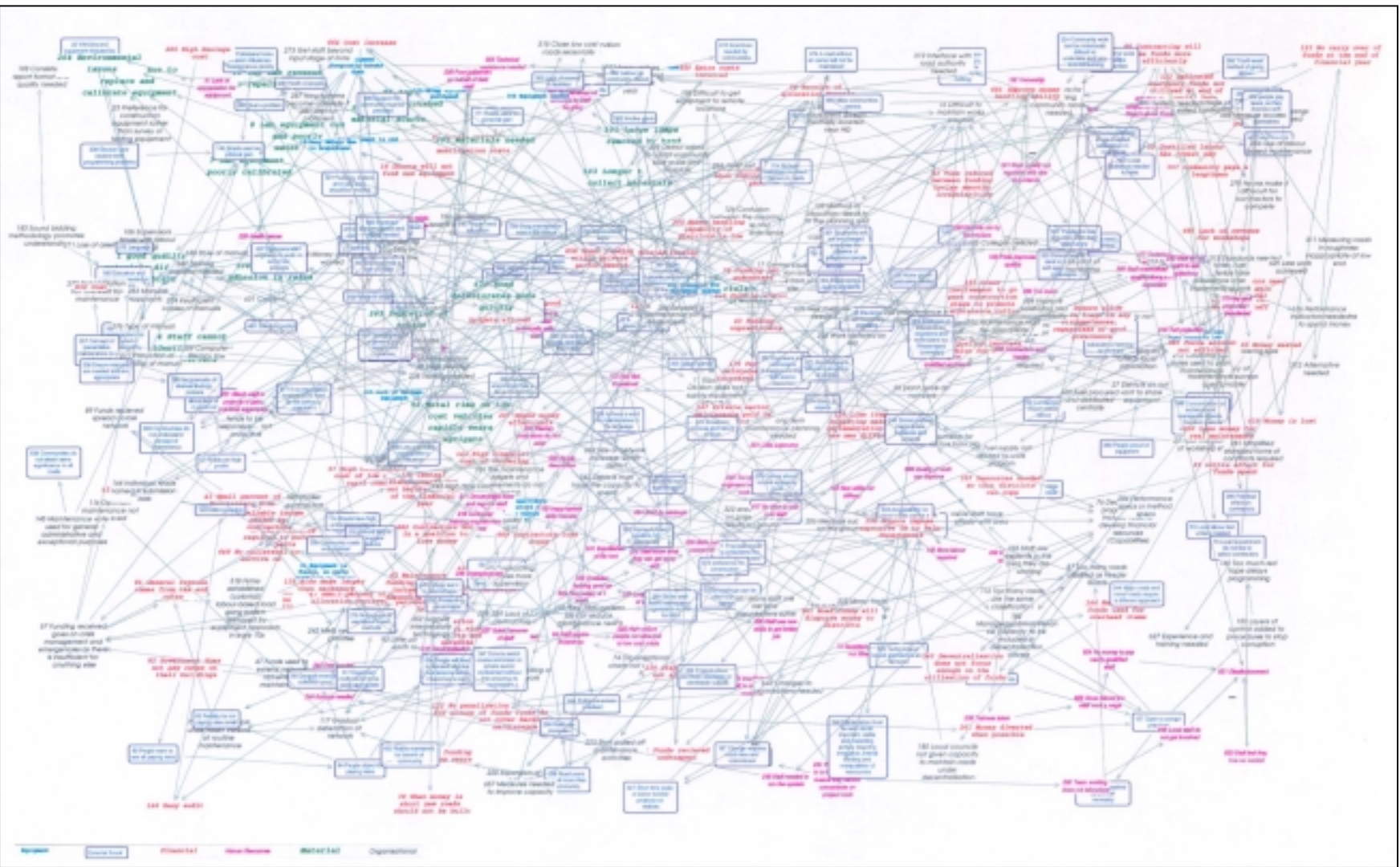
**Figure 3-1 Example of a Portion of a Cognitive Map**

The process of summarising and transcribing the interview information has had the beneficial effect of shortening reasoning strands by approximately  $\frac{3}{4}$ . Resultant concepts are more general in nature, but it was felt amply describe the views expressed. As a result of this summarising process the master cognitive map was found to have some 427 inter-linked concepts rather than a more cumbersome 1,000 odd concepts. A miniaturised version of the Master Cognitive Map is reproduced in Figure 3-2 to demonstrate the complexity of the problem environment that even this relatively small number of concepts captures.

During the construction of the Master Cognitive Map it soon became apparent that the concepts could be categorised into six basic types of categories or concepts. These related to:

- Equipment Issues
- External Social Issues
- Financial Issues
- Human Resource Issues
- Materials Issues, and
- Organisational Issues

Figure 3-2 Miniature Version of a Cognitive Map



### 3.9 Objectivity

As with all analysis that relies on subjective base data, there is an essential requirement to minimise the influence and pre-conceptions of the researcher / analyst on the subject in question. In constructing a master cognitive map, built from the amalgamation of all data gathered, there is a real risk that the builder will imprint his/her own perceptions on the final product, and thereby influence the outcome of later analysis. To mitigate this risk the development of a model of the problem environment and resultant analysis of the interview data was conducted using Decision Explorer computer software, and the model was constructed by the individual that was the interviewer throughout the project.

Decision Explorer is a proven tool for managing “soft” issues – the qualitative information that surrounds complex or uncertain situations. It allows one to capture in detail thoughts and ideas and then to explore them to gain new insight. The result is a fresh perspective and time saved through increased productivity, release of creativity and better focus. In effect the program is an “ideas” management tool that allows;

- The generation of a cognitive map of a groups ideas
- The pulling together of ideas into a coherent picture to help improve understanding of a situation
- The real issues and concerns of individuals behind headline information using advanced analysis facilities
- The one to maintain the richness of data by managing the complexity of it, instead of having to use a weaker overview of the information
- The effective presentation of reasoning through the structure of lines of argument in the cognitive map

### 3.10 Cognitive Mapping Analysis

#### 3.10.1 Computerised Analysis

A strategy of emergent model structuring and analysis was adopted, where by the concept data was entered in a random fashion and the structure of the model was allowed to emerge, rather than be developed in a pre defined manner. This approach allowed the maps content to take a more significant role in its structure and further analysis, and the researchers impact to be minimised.

With undertaking a task of this type, there is always a risk that the final map is not “complete”, in that it does not contain all relevant concepts, and therefore does not give a full representation of the problem environment. A map of this type can never be said to be complete, as it has not been developed from the opinions of ALL stakeholders. In this case the final “Master Map” can be said to be a complete representation of the problem environment as understood by 101 “enlightened specialists”, and it is their version of understanding that is being modelled. For the purposes of this research it was felt that this sample population was sufficient to establish any trends that might occur.

Once a master map had been built a number of analysis tools were used to interrogate its structure to ensure that the model’s logic was sound and that causal links had been entered using a consistent set of conventions. These tools included orphan analysis, Head and Tail analysis and clustering.

#### 3.10.2 Orphans

When building the model some concepts had immediate and obvious links with others, while others were not so clear. Once the map was completed however, it was possible to use the computer software to locate all unlinked or “orphaned” concepts and assess their relevance to the concepts in the completed map. With this broader picture it was then possible to link these orphaned concepts with other parts of the map.



It was found that all concepts generated from the interview could be linked with others, and thus no single concept (or issue) could be said to be unique or not interrelated with others in having an effect on the overall problem of road maintenance.

### 3.10.3 Head and Tail Analysis

Head concepts are the outcomes at the “top” or end of a line of argument. Tails are the starting point or “bottom” of the line of argument. In this case tails tended to be triggering events / initial causes and drivers of change, and the heads tended to represent aspirational or desirable/undesirable outcomes.

The analysis is used as a means to review the chains of argument and ensure that the linking is in the correct direction and overall map logic is maintained.

### 3.10.4 Clustering

To distinguish focus areas or themes within the master map, a process of cluster analysis was undertaken. Clustering provides a breakdown of the model into manageable chunks, and takes no account of the concept text or meaning. The underlying assumption is that the meaning of the concept is gained both from its content, and from the concepts to which it is linked, and its relationships which count in this analysis. Thus, the analysis aims to provide a list of “suggestions of mutually exclusive topic areas”, but further content analysis is required to more reliably identify the boundaries of each topic.

Cluster analysis results should be treated cautiously because analysis relies not only on the cognitive mapping formulations but also on the model being comprehensive, and as already stated this is not the case.

Initial cluster analysis identified twelve “islands” of concepts, where there are a minimum of bridges between the islands. These clusters were then analysed for content and structure to determine an overall theme for each cluster, and to see if any clusters should be merged due to content similarities.

This analysis resulted in the identification of eight main clusters, and a further one subset that described a smaller yet distinct issue area. A “title” was then given to each cluster that best described its content. The titles were as follows;

Cluster Analysis Results	
Cluster 1	Equipment Management
Cluster 2	Maintenance Financial Need Exceeding Funding
Cluster 3	Funds Spent Inappropriately
Cluster 4	Erratic Receipt of Allocated Funds
Cluster 5	Community Participation and Cultural Issues
Cluster 6	High Relative Cost of Rural Roads
Cluster 7	Sustainability and Appropriateness of External Assistance
Cluster 8	Training, Manuals, Human Resources and Documentation
Cluster 9	Materials and Laboratories (Subset Issue)

Once the main merged clusters had emerged and been identified, further master map analysis was undertaken to verify the selection and description of the Main and Subset Issues and interrogate the structure of the Master Map. This analysis included; Hieset Analysis, Potency Analysis, Domain Analysis and Centrality Analysis. The purpose and outcome of each test type was as follows;



### 3.10.5 Hieset / Potency Analysis

The aim of Hieset analysis is to produce hierarchical sets or groups based on a specified set of concepts, in this case the whole map. Each hierarchical set will contain one of the specified set and all the concepts that explain it. However, if the analysis, in tracing down the chain of argument, reaches another of the specified seed set it will stop and not proceed further down that particular chain of argument.

Once the analysis was completed it was possible to determine which concepts were well elaborated and which were not by reviewing the groups produced. Well-elaborated concepts would tend to indicate that that concept was of key concern and worth further examination.

A detailed summary of these and all other sub-analysis results are detailed at the end of this section.

Potency analysis is used in conjunction with Hieset analysis as it takes its information from the Hiesets created by Hieset. By examining the contents of each set, potent identifies concepts which appear in the most number of sets and thus determines their potency, or effect on a range of issue areas.

Results from this analysis again showed an even spread across the concept range. The top twenty-five most potent concepts grouped themselves into three distinct groups. The most potent group (with a rating of 4) was exclusively concerned with funding and related to its unpredictability and inability to meet needs. The second group, (with a rating of 3), was larger and centred around both the gradual deterioration of the network and the role of communities in the road sector. The third most potent group, (with a rating of 2), revolved around equipment and its reliability and repair.

The top 12 concepts identified by this analysis were as follows:

Hieset / Potency Analysis Results			
	Concept ID #	Concept Description	Score
1	39	Funding not guaranteed	4
2	40	Funding unpredictable	4
3	58	Funding Erratic	4
4	131	The maintenance targets and achievements do not match	4
5	61	Dedicated funding mechanisms ensure smoother flow of funds	3
6	78	Large backlog of urgent work	3
7	79	Emergency work undertaken instead of routine maintenance	3
8	116	Optimum maintenance not achieved	3
9	117	Gradual deterioration of network	3
10	125	Road funds do not cover backlog maintenance	3
11	290	Communities suffer	3
12	291	Communities demand better roads	3

### 3.10.6 Domain

Domain analyses each concept and calculates how many concepts are immediately related to it. Through this it is possible to identify which concepts are best elaborated or have a high density of links around them. This provides an idea of which concepts are key issues and may warrant further examination.

Analysis of all concepts gave the following 12 concepts as most significant:

Domain Analysis Results			
	Concept ID #	Concept Description	Links Attached
1	208	Training needed	16
2	301	Options for maintaining community roads needed	14
3	54	Allocation only represents a small percentage of what is needed	13
4	97	High Maintenance cost of low cost rural roads	13
5	345	Donors impose inappropriate measures and projects	12
6	11	Equipment Division does not supply equipment effectively	11
7	58	Funding Erratic	11
8	127	Funds spent inappropriately	11
9	15	Difficult to maintain works program	11
10	66	Contracting will use funds more efficiently	10
11	57	Funds received goes on crisis management and emergencies as there is insufficient for anything else	9
12	146	Roads used as political gain	9

#### Centrality

Finally centrality analysis was conducted. This allows a similar calculation to that of domain density to be carried out. However this analysis calculates the result using more than one level, i.e. not just those concepts that immediately link to the specified concept, but also those which link through them. This provides some insight into discovering the centrality of the concept in the whole model rather than just its immediate vicinity.

In some respects the results of this analysis are most revealing in validating the choice of cluster sets and their content.

The results of this analysis gave the highest ratings as follows:

Centrality Analysis Results			
	Concept ID #	Concept Description	Points Scored
1	208	Training needed.	44
2	57	Funds received goes on crisis management and emergencies, as there is insufficient for anything else.	43
3	58	Funding Erratic	37
4	204	Establish a delivery-orientated environment.	35
5	301	Options for maintaining community roads needed.	34
6	86	Contractors are not paid on time	33
7	11	Equipment Division does not supply equipment effectively	33
8	131	The maintenance targets and achievements do not match.	32
9	116	Optimum maintenance not achieved	32
10	80	Engineering capability in districts is low	31
11	54	Allocation only represents a small percentage of what is needed	31
12	15	Difficult to maintain works program	31

### Robustness Analysis

Once the analysis had been completed, the Master Map's conventions were reassessed and minor changes made to enhance logic and reduce the risk of ambiguities altering the analysis. Each individual concept and link was re-examined and additional links were added to improve the overall homogeneous nature of the issue under investigation, link directions were changed in line with the improved conventions and key interviewees queried to clarify a number of chains of argument. This latter task resulted in additional concepts being added to the map to improve clarity.

Once these changes had been made to the Master Map, Orphan, Heads & Tails, Cluster, Hieset, Potency, Domain and Centrality Analysis was repeated. Again a similar set of clusters were identified, with the same concepts showing a similar predominance, thus confirming the original findings. From this we were able to confidently deduce that the eight major cluster sets and single sub cluster described below are a fair and robust structuring of the problem environment.

In Table 3-3 the findings of these different analyses have been summarised, and have shown again how they tend to substantiate the issue areas defined by the cluster selection.

**Table 3-3 Master Map Sub Analysis Results Showing Top 12 Concepts in Each Analysis**

Cluster Analysis Results			
Cluster 1	Equipment Management		
Cluster 2	Maintenance Financial Need Exceeding Funding		
Cluster 3	Funds Spent Inappropriately		
Cluster 4	Erratic Receipt of Allocated Funds		
Cluster 5	Community Participation and Cultural Issues		
Cluster 6	High Relative Cost of Rural Roads		
Cluster 7	Sustainability and Appropriateness of External Assistance		
Cluster 8	Training, Manuals, Human Resources and Documentation		
Cluster 9	Materials and Laboratories (Subset Issue)		

Hieset / Potency Analysis Results			
	Concept ID #	Concept Description	Score
1	39	Funding not guaranteed	4
2	40	Funding unpredictable	4
3	58	Funding Erratic	4
4	131	The maintenance targets and achievements do not match	4
5	61	Dedicated funding mechanisms ensure smoother flow of funds	3
6	78	Large backlog of urgent work	3
7	79	Emergency work undertaken instead of routine maintenance	3
8	116	Optimum maintenance not achieved	3
9	117	Gradual deterioration of network	3
10	125	Road funds do not cover backlog maintenance	3
11	290	Communities suffer	3
12	291	Communities demand better roads	3

Domain Analysis Results			
	Concept ID #	Concept Description	Links Attached
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6	11	Equipment Division does not supply equipment effectively	11
7	58	Funding Erratic	11
8	127	Funds spent inappropriately	11
9	15	Difficult to maintain works program	11
10	66	Contracting will use funds more efficiently	10
11	57	Funds received goes on crisis management and emergencies as	9
12	146	there is insufficient for anything else Roads used as political gain	9

Centrality Analysis Results			
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6	86	Options for maintaining community roads needed.	33
7	11	Contractors are not paid on time	33
8	131	Equipment Division does not supply equipment effectively	32
9	116	The maintenance targets and achievements do not match.	32
10	80	Optimum maintenance not achieved	31
11	54	Engineering capability in districts is low	31
12	15	Allocation only represents a small percentage of what is needed Difficult to maintain works program	31

### 3.11 Overview Analysis

With material of this type, it is not sufficient to analyse the content of the information gathered during the interview process. Significant information can also be derived from the dynamics of its source, and the overall patterns that emerge from the consolidated information set.

Analysis was conducted on an overview basis by addressing a number of questions to the source and nature of the answers given and issues raised. These questions included, but were not limited to;

- Who said what, (and what was not said)?
- What types of issue were of particular concern to which interviewees & why?
- What issues were repeated many times within which subject and interviewee categories?
- What was the nature of the issues raised?
- Was the context specific only to low cost roads and
- In what context was group concern directed?



## 4. FINDINGS

### 4.1 Clusters

Described below is a summarised narrative on each cluster and its printout. As mentioned earlier the map is incomplete as it does not encompass the views of all (including the reader). The reader should resist the temptation of adding/changing the content of each map as this would impose their own perceptions on the research and thereby subtly change the overall message in the map. It should be remembered that this is a representation of a selected group's understanding of the situation.

In the dialogue we have highlighted the concepts, arguments, contributory factors and mitigating measures and solutions identified by the software, as key to the subject in hand. Obvious solution (although not those necessarily stated by interviewees) have been added or reworded where appropriate, and where it is believed additional contributions and comment are helpful, these have been added in *italics*.

#### 4.1.1 Cluster 1 - Equipment Management

This cluster clearly relates to a well known problem of Equipment Division's not supplying equipment effectively to users, and the effects that this has on maintaining work programs in the field. The cluster identifies some of the causes of this poor performance, both centrally and within the districts. Its prevalence in the Master Map would indicate that effective equipment management, (at all levels), is key to programming.

Significant factors that constrain the effective service provision relate to:

- The remoteness of the work sites and a shortage of suitable haulage equipment
- Poor maintenance and repair capacity's
- Inappropriate procurement and disposal practices
- Seasonal demands
- Poor co-operation and co-ordination between districts
- Centralised procurement and distribution of fuel (and parts) that is not linked to workload or network size

*It is of note that the issues raised in this area are common to the maintenance of all classes of road, and subsequently we would expect a similar cluster to be generated when assessing maintenance at other levels. This would indicate that equipment management is a major issue throughout the road sub sector. The cost of owning and operating equipment is high, and often represents the largest single component of the cost of works. Lack of working equipment has been cited as one of the most significant factors in road maintenance operations that are inefficient (World Bank, 1988). It is therefore crucial that equipment operations are well managed.*

*Richard Robinson et al, in their critique on Road Maintenance Management – Concepts and Systems, summarised current thinking as follows;*

*“Equipment Management is a specialised operation, and should therefore be undertaken by mechanical engineers. However, it is important that maintenance managers understand the basic principals involved if effective and efficient operations are to result from its use. One basic principal is that equipment should normally be managed as an autonomous unit, separated functionally from the maintenance or works unit. The equipment unit should be responsible for the procurement, repair and disposal of all vehicles and equipment, and should rent these to the works units according to commercial principals. (Detailed guidance on establishing and running such a unit has been given by Lantran & Lebussey (1991) of the World Bank)”.*

*In many countries this principal is accepted and has provided the basis upon which equipment services have been reorganised and established. However the logical*

*operational, financial and organisational extensions of the principal are rarely fully translated into practice, and equipment “ownership” is most commonly found in the hands of district works units in the field.*

*With the introduction of autonomous Road Authorities and the move towards contracting as a means of implementation, the issue of “ownership” should resolve itself as contractors eventually use their own equipment. Unfortunately the restructuring and reorganisation of equipment services is rarely undertaken in response to the new status and function of the roads authorities, and problems caused by public sector management of equipment persist with their incumbent cost implications.*

*Unfortunately it is not a simple matter for state run equipment organisations to change from being public to market oriented, and little material exists to suggest how this may be achieved. Recent efforts to address this issue have suggested privatisation as the solution, but implementing such policies has shown to be most difficult. Issues relating to entrenched attitudes, reduced scope for corruption, high capital cost and reduced control of resources have all conspired to block serious efforts to change. Commitment from the highest levels along with incremental change and time is required if any of these initiatives is to succeed.*

*Another factor affecting the poor performance of equipment services relates to skills shortages within the mechanical sector. In our review of existing manuals and procedural documentation we found that equipment management does not appear to given equitable attention compared with the civil engineering sector. In the majority of material researched, equipment management only represents a very small fraction of advice given. It is further significant to note that on the shop floor almost all maintenance manuals are those provided by manufacturers, and the only locally produced documentation is usually directed at operator levels and not mechanics or managers. The lack of skills in this area would suggest that manufacturer’s manuals are not used to a great extent as they are possibly inappropriate to local conditions. There is room for the indigenous development of maintenance and workshop manuals that suit the systems, facilities and resources found in the field.*

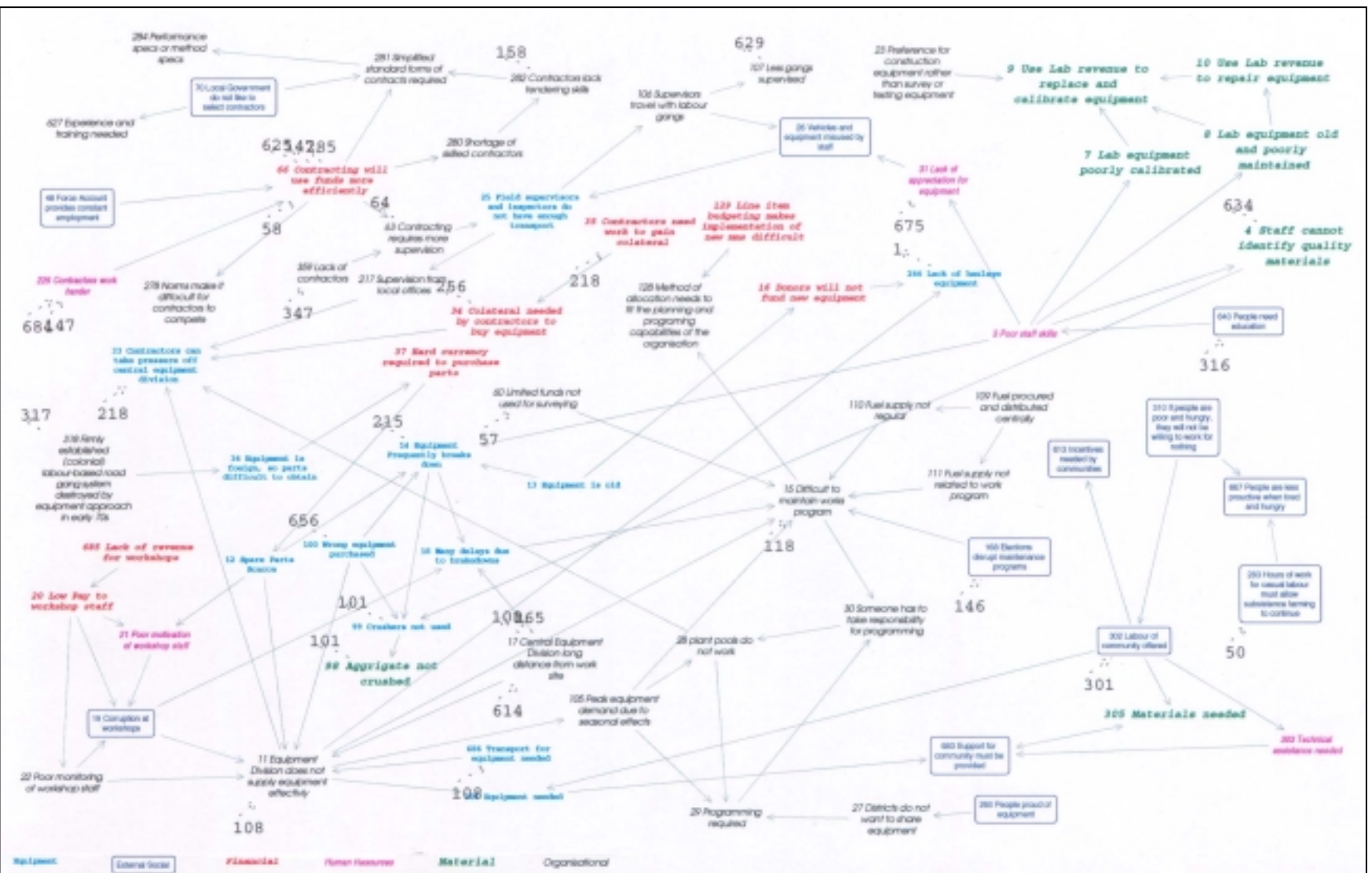
The above notwithstanding, this immediate research would suggest that attention to some of the following measures might help to mitigate some of the existing problems.

Specifically;

- a) Assistance / research to improve and update equipment management systems
- b) Practical equipment management and maintenance manuals and training
- c) Mechanisms to programme sharing of resources between districts
- d) Improved haulage and distribution systems
- e) Ability to outsource equipment and services
- f) Use more labour intensive maintenance techniques and
- g) Use lower cost, more appropriate equipment



Figure 4-1 Cluster 1 – Equipment Management





#### 4.1.2 Cluster 2 - Maintenance Financial Needs Exceeding Funding

This cluster revolved around the statement that “funding does not meet maintenance needs”. This has led to a:

- Deterioration of the overall network
- Large backlog of maintenance work
- Tendency towards crisis management and
- Predominance of emergency work rather than routine maintenance

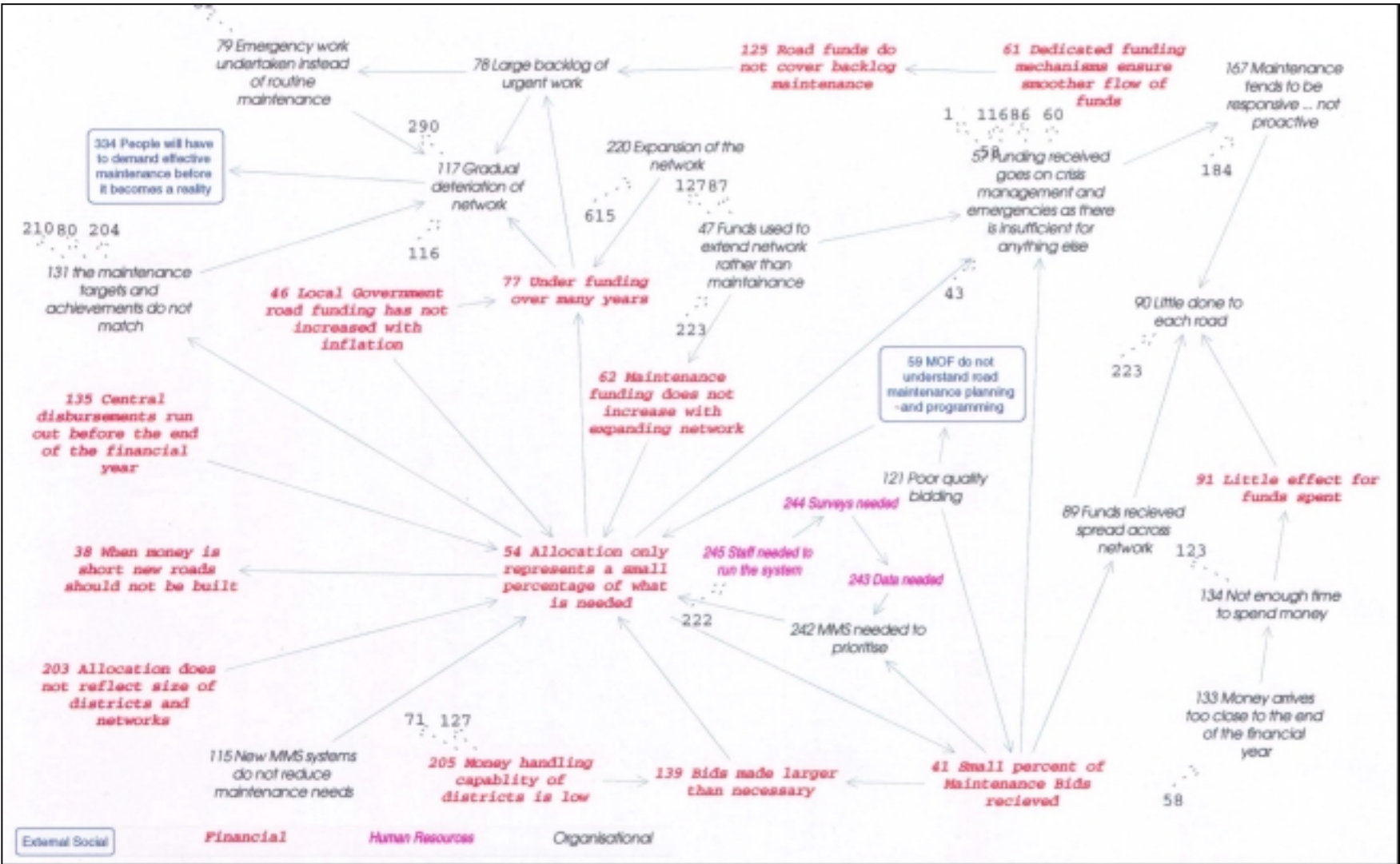
The situation has been aggravated by;

- Funding not being linked to inflation (particularly in local government)
- Decentralised funding allocations and subsidies not reflecting the network size
- Programs of network expansion that are not supported by corresponding extensions of maintenance funding and
- New road fund mechanisms not geared to cover backlog maintenance

A number of mitigation measures and solutions are suggested by the research and include:

- a) Improved systems of prioritisation to stop funds being spread too thinly to be effective
- b) Alternative construction / maintenance methods to reduce cost, (the more effective use of materials is covered in more detail by Element B of the research project)
- c) Tighter restrictions on the construction of new roads
- d) Dropping some roads from the classified network
- e) Allow road funds to cover some backlog maintenance, or a reducing government subsidy to the fund that allows backlog work to be done, (Donors are already assisting in this manner)
- f) Increase the road classification strata to allow more flexible and appropriate maintenance standards
- g) Introduce mechanisms that allow carry over funding from financial year to financial year
- h) Improve decentralised funding mechanisms to include allowances for network size and through traffic

Figure 4-2 Cluster 2 - Maintenance Financial Need Exceeding Funding



#### 4.1.3 Cluster 3 - Funds Spent Inappropriately

The primary causes have been given as:

- A confusion between the terms routine and periodic maintenance
- Poor money handling capabilities at lower levels
- Insufficient staff to undertake workload (due in part to employment embargo's/ health)
- High political profile of local roads that lead to roads being classified by political necessity rather than need
- Inappropriate quality standards and construction technologies

This has led to:

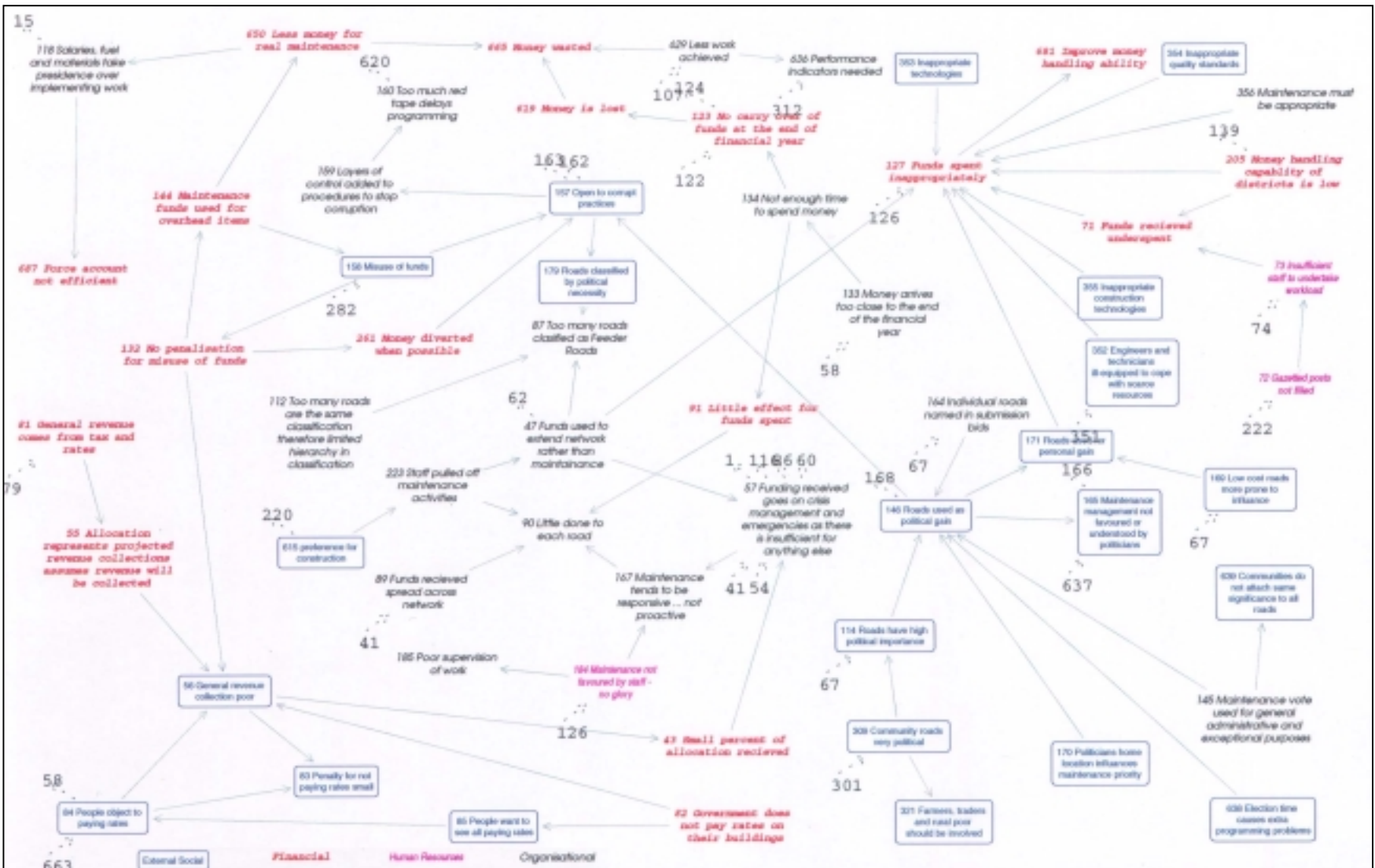
- Inappropriate maintenance interventions
- Funds being under spent by the end of the financial year
- Full allocations not being released by central authorities
- Corrupt practices at lower levels and
- Political interference

Suggested mitigation measures and solutions include;

- a) Improve process of decentralisation by increased emphasis on administrative and financial management capacity building
- b) Introduce mechanisms like staff contracting and performance management, that allow appropriate staffing levels to be maintained
- c) Introduce greater range of road classifications
- d) Encourage enterprise and initiative of indigenous peoples rather than impose restrictions
- e) Involve community in decision making process to improve appropriateness and self audit

*Roads are classified by political necessity. Therefore, improvements in decentralised administrative capacity and systems followed by community empowerment and the gradual lifting of centralised regulatory control may be the most appropriate process of decentralisation and local self audit. This may be a risky option, but has a greater potential to produce more balanced and transparent governance. Many decentralisation programs do not put enough time, resources or effort in first building administrative capacity before handing over financial and asset management responsibilities.*

Figure 4-3 Cluster 3 - Funds Spent Inappropriately



#### 4.1.4 Cluster 4 - Erratic Receipt of Allocated Funds

Many middle level managers and expatriates cited the erratic receipt of allocated funds as a major hindrance to the effective maintenance of low cost roads. This issue had a major effect on:

- Hindering the maintenance of scheduled works programs
- Inhibiting the emergence of private sector contracting
- Increasing the cost of contracting
- Reducing district staff morale and commitment
- Increasing skills loss due to high staff turnover
- Increasing the risk of “raids on funds” and financial mismanagement and
- Reducing community commitment and confidence to the maintenance cause

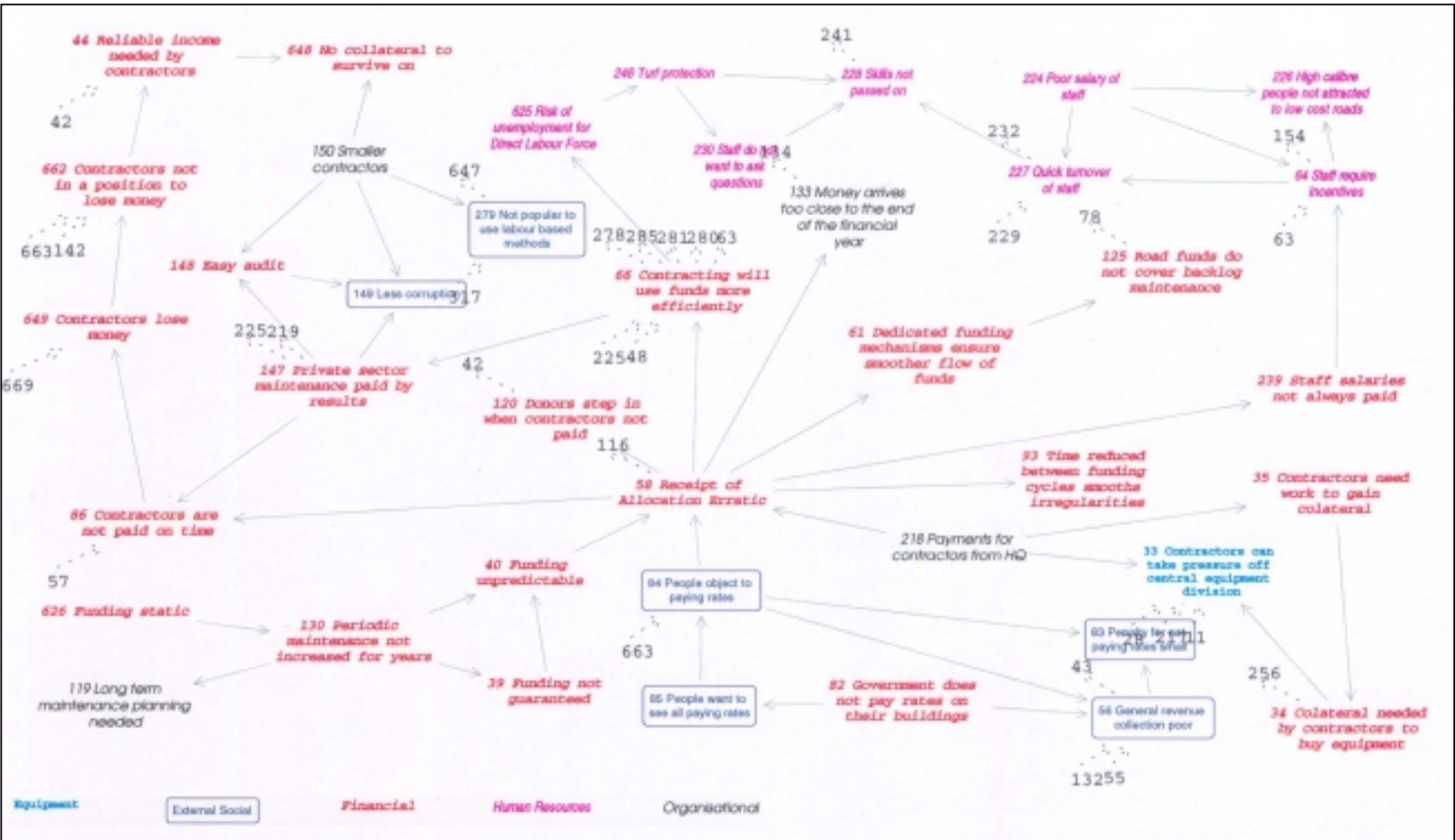
The erratic nature was caused by a number of factors that included

- Poor revenue collection performance at local and higher levels of government
- Erratic central revenue priorities
- A high reliance on aid money, and unpredictable funding from donors, and
- Poor financial management and excessive “red tape” by central authorities

*An interesting cause and effect loop that emerged in this cluster relates to contracting – supervision issues. Although contracting is seen to use funds more effectively, erratic funding is a major hindrance to establishing a viable and competitive contracting environment. But, if a contracting policy was implemented, there would be a greater demand for supervision services by the district staff. This in turn would require additional resources to be made available to allow supervisors to travel and supervise effectively. However with erratic funding there is rarely sufficient or timely allocations made to cover this workload. In most countries salaries, travel and outstation allowances are classed as general overheads, and therefore do not have their budget linked to workload.*

*Given the links and causal strings that connect to this issue, we believe many effectiveness and efficiency gains can be achieved by introducing mechanisms where “supervision” is included as part of the contract cost. In this manner, district managers can be assured of having sufficient funds available to adequately supervise the workload contracted and many of the staffing, logistics and programming problems associated with supervision would probably resolve themselves.*

Figure 4-4 Cluster 4 - Erratic Receipt of Allocated Funds



#### 4.1.5 Cluster 5 - Community Participation and Cultural Issues

Cluster 5 is an amalgam of issues raised, that stem from the high profile roads enjoy in day to day life. This high profile often results in roads being used for political gain by local and national politicians, often for personal rather than community gain. This situation can lead to inappropriate initiatives with respect to both users as a whole and limited resource expenditure.

This raises issues that impinge on the day to day operations of maintenance units, and raises the issue of “ownership”.

Empowerment of communities to enable them to influence the decision making process and participate in the maintenance process, (and therefore benefit directly from the financial resources being spent to maintain the roads), is seen by many as the way forward in maintenance management, particularly for low cost rural roads. Once communities enter into the equation many social and cultural factors begin to influence appropriate approaches to methodology and progress.

It would appear that the interviewees fully recognise that many options are possible for communities maintaining roads, but these appear to be poorly, if at all, developed and in need of identification and publication.

*This may well signify that further research is needed to identify options and methodologies to incorporate the participation of communities in the road maintenance process. There have been successes with regard to community participation in road construction, yet road maintenance has not always followed on from the successes. It may well be that in other sectors and sciences, many tried and tested approaches to community participation exist, but practitioners in the road sector seem particularly ill-informed of the softer or more social aspects of participatory management and administration. This may well be due to the historical “isolation” of roads authorities from the using public due to tribalism and the like, or a cultural issue where the comparatively highly educated roads staff have difficulty communicating to rural peoples. It was noted that the use of locals to facilitate the co-operation process was recognised, however no suggestions were put forward to suggest how this may be achieved.*

*From our interviews with middle level management, it would appear that attitudes are changing, but managers are poorly equipped with communication and negotiation skills to effectively operate in this environment.*

*To gain the full benefits of a significant shift towards local “stewardship” many attitudes and cultural changes will probably be required. It is noted that changes of this nature will need to be introduced incrementally over a long period of time. A factor that is not supported by the “short termism” of the aid programming cycle.*







#### 4.1.6 Cluster 6 - High Relative Cost of Rural Roads

Cluster 6 identifies many of the factors that cause the construction and maintenance of low cost rural roads to have a high cost. Key factors identified include:

- Lower quality contractors and labour skills in rural areas
- High mobilisation costs of remote work sites
- A scarcity of quality materials, and their high cost
- Equipment problems due to remoteness, and
- The higher deterioration of roads constructed with lower specifications

The interviewees identified no clear strategy for mitigating these problems, but through a review of other material, and other parts of this research, it is clear that efforts are in hand to;

- Improve contracting skills in rural areas through training and introductory contracting programs
- Reduce the cost of roads using marginal materials, (see Element B of this research)
- Promote the use of low cost equipment techniques such as tractor based technology
- Research the use of chemical treatments to prolong pavement life (see Element D of this research)

Similar to Cluster 5 - Community Participation and Cultural Issues, there again seems to be significant community / cultural issues that play a role in raising the cost of rural roads, and yet interviewees did not raise known solutions. This suggests that there are still many questions unanswered in the identification of appropriate methods to improve the cost effectiveness and social acceptance of rural contracting.

One comment of note that may lead to learning and the identification of options: this stated,

*“Firmly established (colonial) labour-based road gang system destroyed by equipment approach in early 70s”.*

*Many countries probably feel they have moved on from labour based methods and to use them once again would be to take a backwards step. “We have gone past that stage”, was the comment of one expert. The promotion of intermediate technology should therefore take into consideration the attitudes of potential users. People tend to feel that because they have once had working equipment, it is their right to have it again. This is regardless of the fact that the capacity may not exist to allow equipment-based methods to be used effectively.*



#### 4.1.7 Cluster 7 - Sustainability and Appropriateness of Donor Assistance

Cluster 7 covers the broad subject of sustainability and external (donor) assistance. The most significant factors identified (through the amount of connectivity to other concepts in the cluster) are as follows:

- The fact that decentralisation programs do not include tools to enable the development of financial capabilities of organisations, with particular emphasis on District and similar sized establishments
- That some of the measures and types of project imposed on consultants and hence the recipient organisations are inappropriate to their individual needs.
- The issue that institutionalisation of projects and hence their sustainability, is an area of concern for many
- The demand for decentralisation by donors, without the necessary capacity building of the private and public sector

*The fact that donor assistance to organisations normally involves the arrival of an outside party is only part of the problem. Not all the blame for inappropriate projects and measures can be directed towards the consultants. They are usually tied to tight time constraints and are therefore less able to allow the organisation to develop its own ideas, and hence to establish the all-important ownership. The fact that there is not more time for the consultant to become involved with the recipient organisation and hence understand its role, means that the solutions are not always effective or appropriate. Resentment by staff and the fact they do not feel in control will all have an effect on the sustainability of the project measures. One possible solution to this problem, identified within the cluster, is the fact that the time scales of donor funded projects should be made more realistic. This would allow the consultant to reduce their input over a period and hence encourage acceptance of the measures by the organisation, by maintaining ongoing support for a period of years, rather than months.*

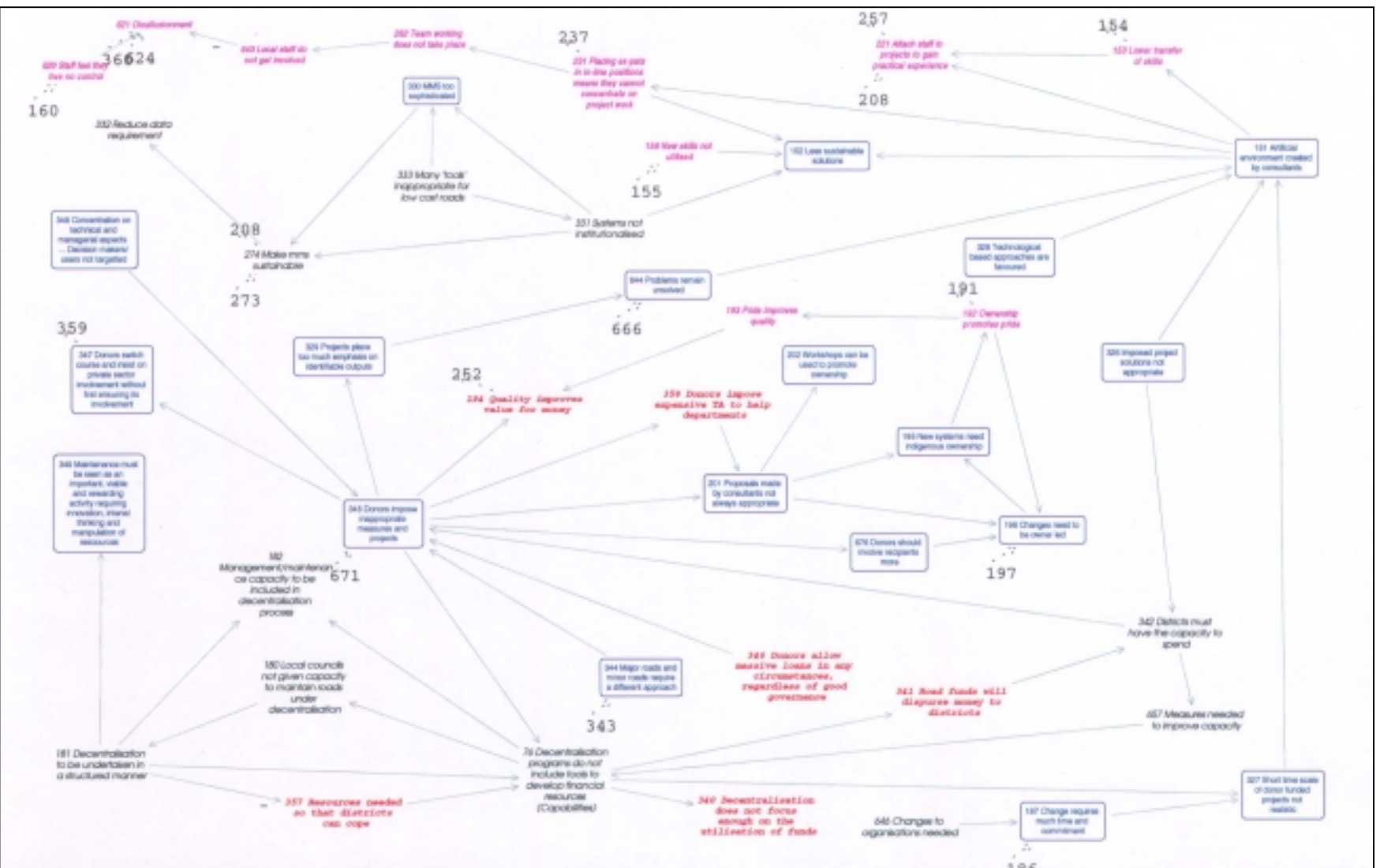
*An interesting example is the current pressure to decentralise being exerted by various organisations. It is a proposal that should hopefully increase efficiency through the use of contractors. However, the fact that the capacity has to be built first cannot be ignored. It is accepted by many that contracting is a more efficient use of limited funds than the force account system. Yet, without an established group of contractors of different disciplines to carry out the work, the burden on the organisations actually increases. Increased supervision and training/ equipment issues are likely to weigh heavily on an organisation already struggling to function.*

*Another comment of interest is the fact that too much emphasis is placed on identifiable outputs from projects. It is easy to understand why the donor requires such an output. However, if the project requires institutional issues to be tackled then such outputs cannot be realised in the short-term.*

A strategy for resolving the problems mentioned can be summarised as follows:

- Decentralisation programs should include tools to allow the development of financial capabilities of organisations
- Ensure that the projects funded by donor assistance are appropriate and relevant to the organisation and are actually wanted
- Ensure projects are developed with the input of the recipient organisations, to encourage participation and sustainability
- Ensure any demands for decentralisation are accompanied by the necessary capacity building measures

Figure 4-7 Cluster 7 - Sustainability and Appropriateness of Donor Assistance



#### 4.1.8 Cluster 8 - Training, Manuals, Human Resources and Documentation

As the subject area covered by this cluster was the initial reason for this research project, analysis of the cluster and supportive work produced a much wider knowledge set than all other clusters. Set below is brief summary of the issues raised by the cluster.

It is no surprise that the issues of training, human resources and manuals are inter-linked, and as a result, difficult to separate out. An interesting comment made by one interviewee was the fact that training (and hence manuals) only play a part when the staff actually have the resources to undertake work. If the funding is so low that they cannot get out on the roads and do maintenance, then it could be argued that training would be wasted. The counter argument to that is obviously the fact that if finances are stretched, then training to improve the money handling capabilities of organisations would be practical and useful. This demonstrates the most important issue pertaining to training and indeed manuals:

- That manuals and training should be appropriate
- Areas needed where education and training can be provided
- Education for communities regarding road maintenance required
- Education for politicians regarding road maintenance required
- Education for road users regarding road maintenance required
- Education for staff relating to:
  - Financial skills
  - Computer skills
  - Maintenance techniques
  - Management techniques

*It is a sad fact that road maintenance is the poor cousin to road construction. As a result, staff do not always regard maintenance as a meaningful activity. Attracting well-qualified staff to maintenance organisations can be difficult. Such a problem is even more pronounced for the smaller organisations, (district offices and the like). Areas identified that relate to human resources are as follows:*

- Lack of qualified and experienced staff on some countries
- Lack of incentives for staff and hence lack of motivation
- Staff shortages leading to overworking of staff
- Lack of organisation and regulations for staff to abide by
- Frequent employment embargoes
- Loss of staff due to illness and death
- Cultural problems such as nepotism and favouritism
- Influence of politics on employment of staff
- Fear of unemployment and turf protection

Manuals are related to training, and do have a part to play. Manuals either have to cover a very specific subject, which allows them to be used as reference documents. Or they have to accompany training. “Getting manuals off the shelves and into pockets”, was identified by one interviewee as an issue of importance. Whilst this is true, it has to be recognised that manuals are merely part of the solution and not a solution in themselves. Consultants often produce manuals, which are left with the recipient organisation when projects are completed. Yet the provision of the manual will not itself ensure sustainability of the implemented ideas. If however it is decided that a manual will address an issue of importance and is required by the organisation, then the measures suggested in Volume II of this report which give guidance on what to think about when writing a manual should assist:

- Content and structure of manual
- Type of manual
- Aesthetics and Language
- Cost and circulation





#### 4.1.9 Cluster 9 - Materials and Laboratories (Subset Issue)

Cluster 9 differs from all others in that it reflects a succinct technical area and is significantly smaller than others. It covers issues relating specifically to materials and laboratories. The cluster has probably occurred because it was of particular interest to a very focused group or individual in the interviewee set.

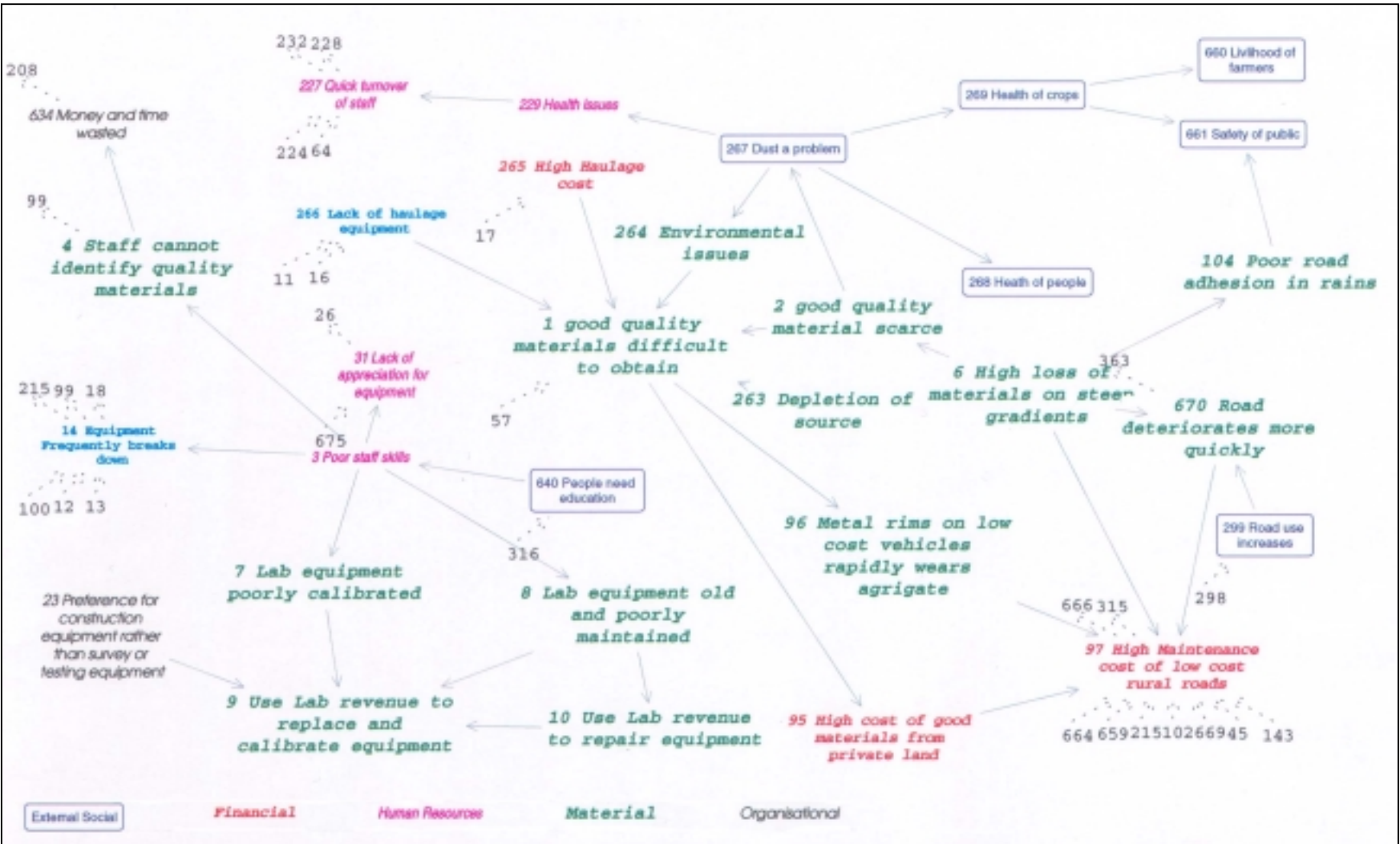
Fortunately, not all organisations can claim they have problems relating to materials. However, whilst some regions and countries may have sufficient materials of sufficient quality, they may still suffer due to issues which at first glance are not materials based at all. For example, the issue of equipment has been discussed already in 4.1.1 yet it can have an effect on materials too. The lack of working crushers, or rollers is an equipment issue which has a direct impact on materials. It may mean that oversize material has to be used and as a result the cost of road maintenance will increase due to the time taken to hand remove the oversize. Another example relates to human resources and whether or not the staff are skilled enough to locate the good quality materials and then test them. A financial issue is whether or not funding exists to purchase materials from private landowners and if not, then poorer quality materials have to be used in place of the better quality materials.

Issues which are specifically related to materials include the following:

- Decline of good sources
- Environmental considerations
- Testing facilities
- Haulage issues

Materials are obviously fundamental to road maintenance, and the fact that only a small subset exists which considers such issues, does not trivialise the problem. As already stated it means that in the countries visited, the people spoken to did not regard it as such an important issue. Element B of this project addresses many of the issues relating to the identification of suitable materials and their subsequent treatment.

Figure 4-9 Cluster 9 - Materials and Laboratories



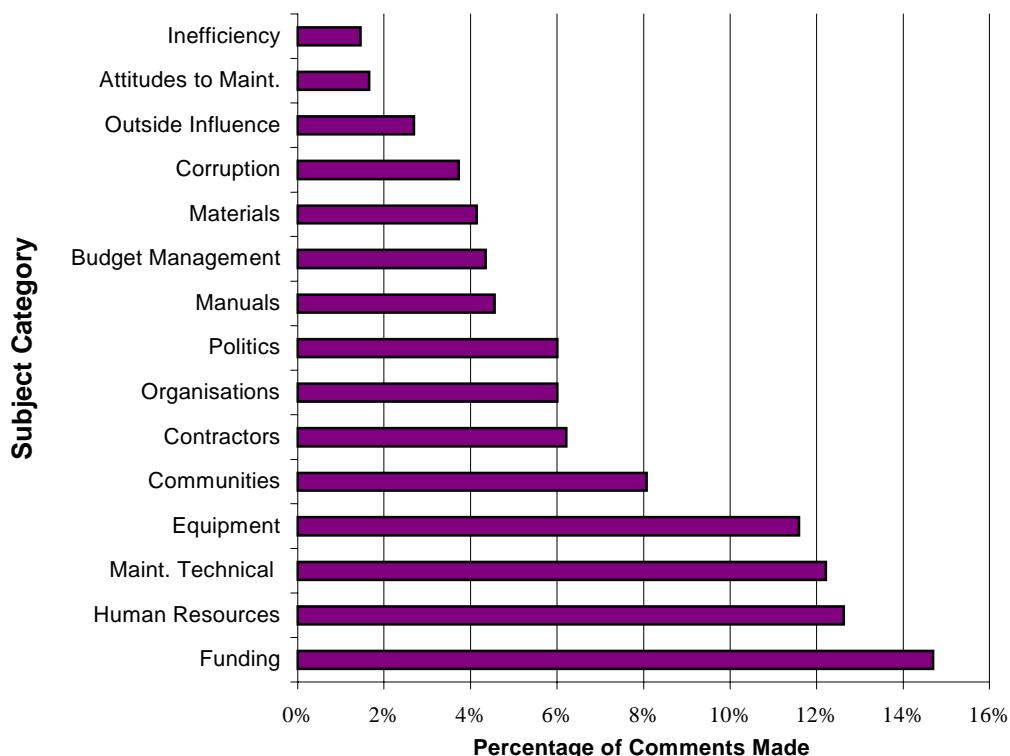




### 5. OVERVIEW ANALYSIS OF COGNITIVE MAP AND INTERVIEWS

A breakdown of the categories and frequency of the subjects raised is given in Figure 5-1. (The figures have been developed from the number of times an issue was raised, irrespective of it being repeated by another interviewee.)

**Figure 5-1 Interview Subject Analysis**



An analysis of only the number of issues raised, not including repeats, show that maintenance technical issues predominate and account for 14.5% of all issues raised. Closely followed by human resources with 12.5% and Communities with 12% and Funding with 11.4%.

These results would indicate that issues relating to finance, human resources, technical maintenance and equipment were of primary concern to the interviewee group. This predominance would tend to confirm traditional views of the main constraints to effective maintenance.

When looking at whom said what within these subject categories, the results are more or less predictable. A summary of responses for each subject category is shown below:

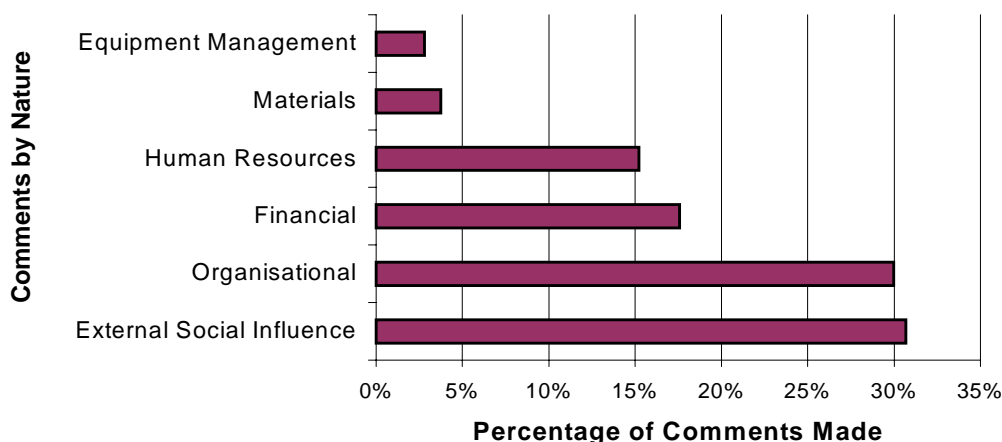
**Table 5-1 Summary of Responses for Each Subject Category**

Subject	Interviewee Group			
	Ex-pat	Hi Level	Middle Level	Low Level
Funding	26 (37%)	24 (34%)	20 (28%)	1 (1%)
Human Resources	29 (48%)	12 (20%)	20 (33%)	0 (0%)
Maintenance Technical	29 (49%)	13 (22%)	13 (22%)	4 (7%)
Equipment	12 (21%)	9 (16%)	28 (50%)	7 (13%)
Communities	24 (62%)	4 (10%)	10 (26%)	1 (3%)
Contractors	20 (67%)	8 (27%)	2 (7%)	0 (0%)
Organisations	20 (69%)	2 (7%)	7 (24%)	0 (0%)
Politics	11 (38%)	12 (41%)	6 (21%)	0 (0%)
Manuals	7 (32%)	3 (14%)	12 (55%)	0 (0%)
Budget Management	8 (38%)	3 (14%)	9 (43%)	1 (5%)
Materials	7 (35%)	3 (15%)	4 (20%)	6 (30%)
Corruption	15 (83%)	3 (17%)	0 (0%)	0 (0%)
Outside Influence	10 (77%)	1 (8%)	2 (15%)	0 (0%)
Attitudes to Maintenance	5 (63%)	2 (25%)	1 (13%)	0 (0%)
Inefficiency	4 (57%)	0 (0%)	1 (14%)	2 (29%)

This shows, for example, that expatriates provided insight into a wide range of issues, whereas members of senior management were interested in high level issues, particularly funding, and middle level managers described predominantly operational constraints. Unfortunately there were insufficient lower level staff questioned to define definite trends.

In developing the Master Cognitive Map (MCM) the manner in which the comments had been made was examined and it was found that again a distinct set could be identified. This set did not necessarily always cover a subject category, but identified the nature of the 426 issues or concepts shown in the MCM. The set identified was analysed and results are shown below.

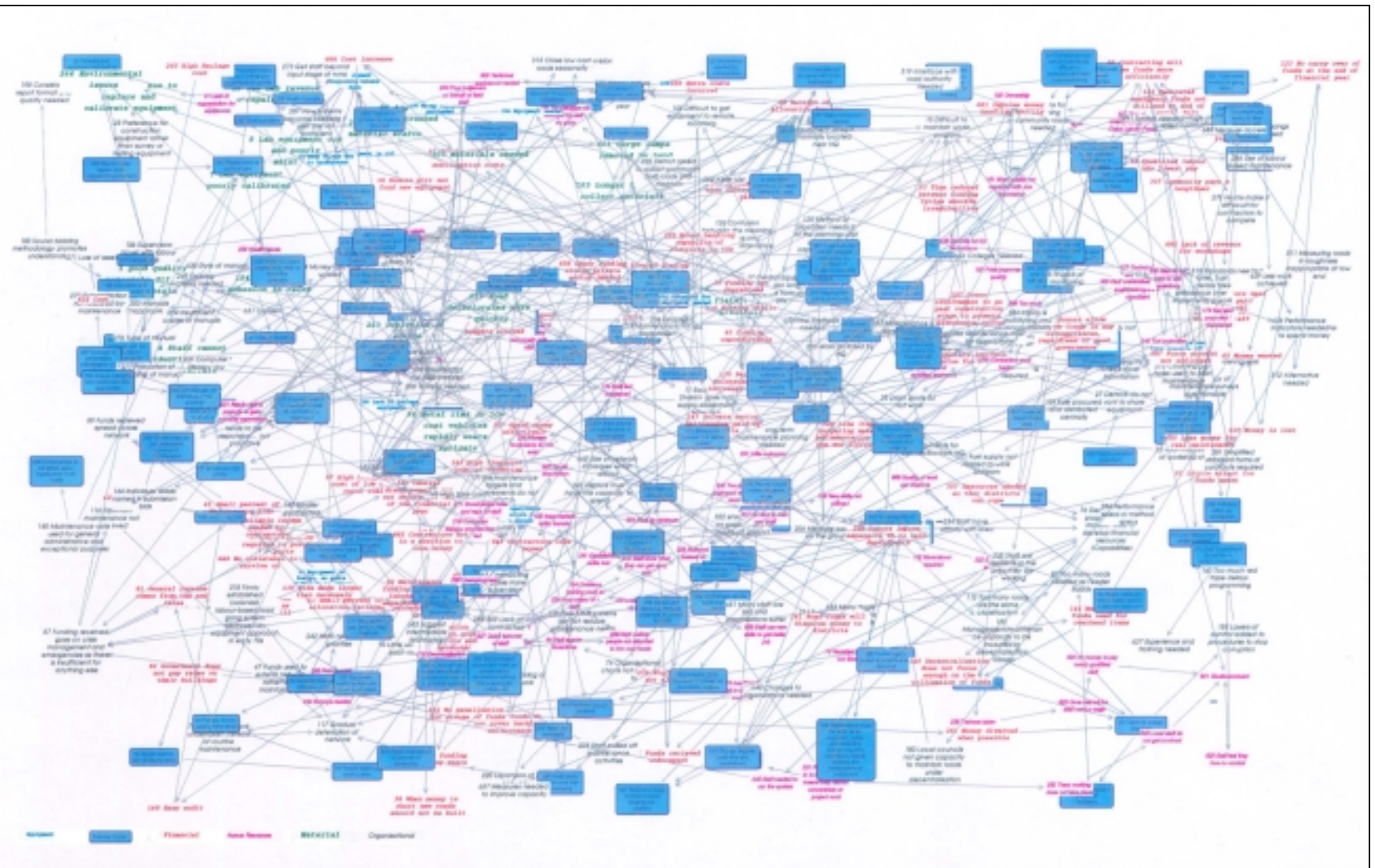
**Figure 5-2 Interview Analysis by Nature**



The results of this latter analysis are possibly the most significant of this research. It would indicate that despite the traditional view, that the problems facing effective maintenance are mechanistic by nature and can be dealt with systematically within the maintenance organisation, in fact the majority of constraints are social in nature, and predominantly derived from external factors. This would tend to suggest that to gain maximum benefit from efforts to improve maintenance effectiveness, a re-orientation from scientific to socially based research and development may be appropriate, and that this should be focused at the social environment at large rather than maintenance organisations in particular.

This finding is dramatically demonstrated in the MCM. In Figure 5-3 the MCM, has been reproduced with the External Social Influence concepts highlighted. The map clearly demonstrates the all-pervading nature of these influences.

Figure 5-3 Master Cognitive Map with External Social Influences Highlighted



## 5.1 Discussion

It is of note that the results have been obtained from information provided by a set of "specialists" whose key professions and responsibilities are technical and who hold positions that are senior and to some extent removed from direct contact with the user public at large. Had the interviewee set included equitable representation from lower levels of management, artisans, and community / user groups, a more socially oriented information set would have been expected.

The inference of this finding is that the traditional quantitative methods of research and solution building in the road sector, which can be described as a top down approach, may be limited. They are not designed to address the dominant but underlying social core of the problem environment, but rather technical and organisational issues that result from the social environment.

The findings also suggest that given the dominance of these externally oriented social influences, perhaps top down research should be regarded as a starting point to identify where further investigation should be directed and solutions sought, rather than a source of solutions in itself. More work is required to understand external environments and developing systems and solutions within that context. Rather than attempting to develop solutions based on our knowledge, developed from where the internal environment of maintenance organisations interface and conflict with the external environment. The findings suggest that those maintenance regimes developed and structured from within the social and cultural environment are more likely to be successful in the long term when assessed against locally developed criteria, standards and operating mechanisms.

This research has been conducted in a top-down manner, with an aim of achieving global understanding. But as only "experts" within the maintenance organisation, (local and expatriate), were interviewed, the resulting model can only be regarded as the organisations perspective, and not a balanced overview of the whole situation. Despite this the "organisation" has identified the overriding social dimensions of its environment as the main problem but not a keen understanding of that environment. This is demonstrated by logic strings ending when they come into contact with social constraint, rather than continuing in detail to describe what factors have caused that social constraint.

Recent work by others such as ILO ASIST and the World Bank would tend to support this view that new approaches should be developed using a bottom-up (or outside-in) orientation, rather than reinforcing existing maintenance organisations, processes, resources and funding until maintenance is achieved. However the MCM would also tend to suggest that this approach alone would not address the organisational (regulatory) constraints that lie outside the maintenance organisation itself.

There is unlikely to be a single generic solution to this complex question, and a local country by country analysis is required using techniques such as Participatory Rural Appraisal (PRA)<sup>7</sup>. PRA is a technique that helps to identify the important issues and priorities of local communities by encouraging their active involvement. The research should have a rural focus, with a protracted project preparation phase to ensure that a full understanding of all stakeholders aims and constraints are known before a process style approach is developed to identify and implement alternative options. Such an option can be described as 'bottom-up'.

Many of the financial and organisational constraints would appear to be caused by out-dated legislative and bureaucratic regulations that are founded on expenditure accountability rather than output performance, personal initiative and flexibility. Concurrent top-down efforts are required at higher levels to ensure that regulatory environments are updated to create suitable enabling environments in which the bottom-up initiatives can exist and flourish.

Systematic and concurrent attention to the appropriate capacity building of localised institutions (district and community authorities) is required, particularly in areas of resource

management and accountability. It will also be necessary if the delegation of authority and decentralisation processes is to be successful.

Research is required to identify and develop flexible facilitative tools that can be used in a rural setting to build community organisations and create trust and co-operation with public service organisations. Both public servants and “local” facilitators need to be well versed in the use of these tools and confident to work in an environment of interaction and co-ordination with the public.

There is a wealth of indigenous knowledge available, and other sectors such as agricultural extension are experienced in working in this environment. This knowledge and skill need to be channelled, better supported and disseminated effectively.

It is hoped that trends towards sustainable livelihood development style programs may create opportunities in which the road maintenance practitioners can develop closer links with the community and other public sector colleagues and thereby develop the appropriate social skills needed to create co-operative approaches to rural road development.

## 6. IMPLEMENTATION ISSUES – TIME FOR A RETHINK?

Problem solving in developing countries has relied largely on the top down approach, which reflects the western rationalist culture and experience. In the western developed countries, solutions can normally be derived from objective analysis and the application of available money and technical skill. But this is a recent phenomena. Even at the end of the 19th century the need for a bottom-up approach was recognised in the UK by the creation of powerful local authorities to provide communities with locally derived solutions to problems of health, education and poverty.

From the issues raised in the Master Cognitive Map it is clear that no single solution exists and that unique solutions should be sought for each environment. The Map indicates the problems, and therefore solutions will not be found within an organisational or social strata, but rather will have to be sought working from several directions at once. The map, (and current thinking), would indicate that a bottom-up approach to maintenance may suggest alternative and more appropriate mechanisms, using the local communities as a focal point. However, complete workable solutions will not be possible unless appropriate regulatory and legislative environments are in place to empower communities to take on new roles, and decentralised authorities have the necessary administrative capacity to regulate new systems in a fair and transparent manner.

The findings suggest that it is not sufficient to adopt a purely bottom-up approach to developing alternatives, but rather a co-ordinated bi-directional one to tackle issues from both community and government authority perspectives.

The Master Cognitive Map would seem to confirm that the rational administrative structure seems to be undermined by lack of financial resources and that rural road maintenance is a low priority. Instead of rationally facilitating it, the formal institutions create problems and arbitrary constraints. Conventional assistance is often directed at getting the institutions and technical procedures to work more closely to the Western Model in association with conventional conceptions of fact-finding and research.

Frustration occurs when this approach doesn't work. While such frustration may be justified when dealing with main roads, the findings suggest that for local roads, where conditions are so different, conventional expectations must be suspended and alternatives considered.

The following quote from a respondent catches many of the inappropriate expectations which come from western based practices and procedures .

“Many systems are based on roughness, but it has now been accepted that rural roads should not be measured using roughness. They should be measured on access, but how do you measure it? Many people want to put a number to it, so how do you put a value on people's time, with regard to their accessibility. The IRFTD would say you go to a few villages and you find what people need, their priorities etc. Yet if you are a district engineer in the MoW, and you go to a village and ask what are their main needs, you will probably find that their main needs are actually a water source, due to the fact they are head-loading in and out of their nearest water source. So the district engineer will find he can't actually help them with their main needs, i.e. that they need a closer water source. A roads authority can't deliver those type of needs, it is difficult to generalise, and this is why roughness is used, it is quantifiable, it allows A and B to be compared. If, you are a donor putting in money, you do need numbers, so that you can quantify and justify what you give. Every district is very different, how do you do it and how do you pay for it. Is it worth doing district level studies, are the findings relevant? Is one district representative of the country, or even of the entire developing world? Obviously not.”

The centrality of the belief is that bespoke and radical alternatives and options, which are based on “locally grown” bottom-up regimes, provide the only alternative to the dilemmas that are found in today's public service led maintenance systems. As a result a detailed rational and approach has been developed to describe how the work might go forward. Due



to its importance, this has been reproduced in its entirety as a stand-alone critique produced by the University of Birmingham. The following sections (6.1, 6.2 and 6.3) give an overview of the key elements of the critique.

### 6.1 Bottom Up Approach – Empowerment & Devolution of Responsibility

The foregoing overview has been based on subjective data and the problems of objectively substantiating any such overview have been argued. The research has tried to make sense of the extensive information accumulated and it must be submitted that it is as accurate a version as any such overview can be.

It is now appropriate to consider in more detail a methodology to address the bottom-up aspects raised by this research, and which does not *start* from trying to achieve an overview and statistically validate it. Rather, it starts with the aim of situated understanding. Some reasons for doing so have been rehearsed already. The following quote from Edmonds serves to focus some further implications

He quotes a study undertaken into labour-based methods, which failed to convince engineers that the methods were better: *‘There was still however the question of attitude. All the studies, seminars, books that have been produced on the subject would not convince engineers who, either from experience or from their education, knew that labour-based methods were inferior’*<sup>8</sup>.

Though he is talking about labour-based methods, the following general conclusions can be drawn:

- Conventional studies (such as the one referred to by Edmonds in his *Appropriate Road Transport Technology* paper in 1979), are questionable because of the intrinsic problems
- If they do not coincide with experience, they will be questioned
- Their value as a basis for action and for persuading people of the ‘facts’ is therefore itself questionable
- If we wish to persuade people to change their attitudes, it is most effectively done through exposing them to the appropriate experience - though, of course, this cannot be guaranteed

The argument throughout has pointed to the need for alternatives both in research and practice in the matter of more effective low cost, road maintenance. The alternative approach now considered addresses many of the issues raised and introduces the concept of ‘situational understanding’. Situational understanding in the present context, implies that instead of asking the conventional question: “Why is appropriate and efficient maintenance so difficult to achieve?” the question that could more appropriately be asked is: “Why should the low cost roads be maintained and who will benefit?” The answers involve techniques such as Rural Participatory Appraisal and the principals of lean construction (6.2).

Opportunities for increased funding for maintenance in developing countries is small, and therefore the most efficient and appropriate use of the available funding is through the appropriate utilisation of local materials, labour, simple tools and techniques and, most importantly, the proactive involvement of the immediate beneficiaries. Many initiatives world-wide are actively pursuing this objective, some supported through the Development Policies Department - an organ of the ILO. In their *Advisory Support Information Services and Training for Labour-based Programmes (ASIST) Bulletin No 7*, Mbara, for example, a report on people-centred planning systems for rural transport development is given:

*'Decentralisation enhances a greater participation by the beneficiaries at a local level. Community involvement and participation at a local level are imperative for a number of reasons Firstly, it is important in promoting and strengthening democracy and accountability, since people participate in issues related to their own governance and development. Secondly it helps in reducing bureaucracy and increasing efficiency since the levels of decision making are minimised. Finally, it ensures sustainability of projects and programmes since the communities consider the projects as community projects as opposed to those that are externally imposed'<sup>9</sup>.*

This shift in emphasis in the matter of rural development is formally supported by DFID:

*'DFID's stated approach will be "people centred, community focused project orientation". That is finding out why people are in the condition they are in, and helping them to improve the situation. If we are talking about the dispossessed and the disenfranchised, this is not an easy thing to do. Sure we talk to government departments, international agencies etc., but do we ever get involved with the poor themselves? If you consider how remote some of us are from the so called underclass in our own country, it is difficult to imagine that we understand the real priority needs of people living in urban squatter settlements in Nairobi, or a deserted mother of a young family in rural Bangladesh' ..... 'Health and education development projects always have a good impact. Professionals in those areas are used to dealing with their target groups and seeing good results' ..... 'Finding staff to build a metro system for an Asian Tiger economy (and they still have plenty of poor people) is a lot easier than finding a team to plan and upgrade an informal settlement through community contracts, or determine the access needs of a remote Tanzanian district'<sup>10</sup>.*

While, as Airey and Williams report (1998), the projects do not need professionals, it is believed that there are some management techniques developed for high level manufacturing industries in the advanced economies, which can help facilitate them. And also provide a role for professionals more in keeping with the research principle of situated understanding.

**6.2 Lean Construction Thinking and its Relevance**

Lean construction thinking, developed in part from the work of Shewart and Deming can provide a way of introducing more rational planning techniques, budgetary controls, evaluation criteria and so on, but at the same incorporating and making full use of local concerns, knowledge and skills. Key principles are *continuous improvement, empowerment and transparency*.

The essence of the approach is focussed improvement. It is context specific. The key issues which are addressed in this focussed (non-generalised) way are those raised at the outset of this discussion: Why should roads be maintained? Who benefits? Who maintains roads? These lead to questions of who should/can maintain them (local contractors; local community)? And to what standards? How can they be achieved?

**Figure 6-1 Relationship Between Engineering, Technical Knowledge and Local Issues.**



Engineering/technical criteria are considered in the context of local ones; terrain, weather, materials, labour supply, etc.

The logic of the improvement strategy derives from Lean Construction thinking and practice (Ballard and Howell)<sup>11</sup>. (See Figure 6-2 ). Starting at the 'point of production' where value is added:

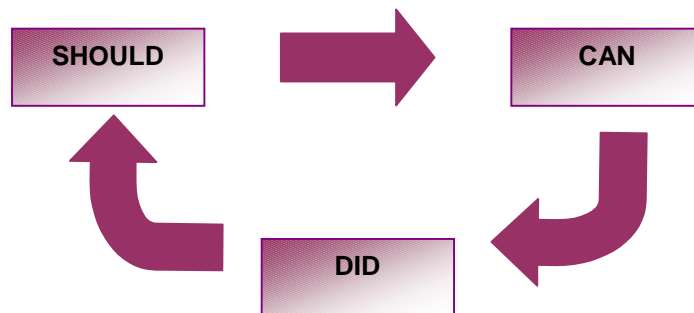
**SHOULD** (i.e. what, from a technical point of view is ideally possible), is negotiated in the context of;

**CAN** (what is realistically possible in the circumstances). Benchmarks are set. That is, some output measure, *agreed* by participants as *relevant* are established. What was actually accomplished;

**DID** is measured against the agreed benchmarks. Reasons for shortfalls are established. They are eliminated (where possible) or adapted to (where necessary).

Improvement and learning cycles produce situationally relevant capability and 'know how' which can be expressed as:

**Figure 6-2 Improvement Cycle**



The improvement cycle follows Shewart's PDCA Cycle of Planning, Doing, Checking and Acting (See ) and works as follows:

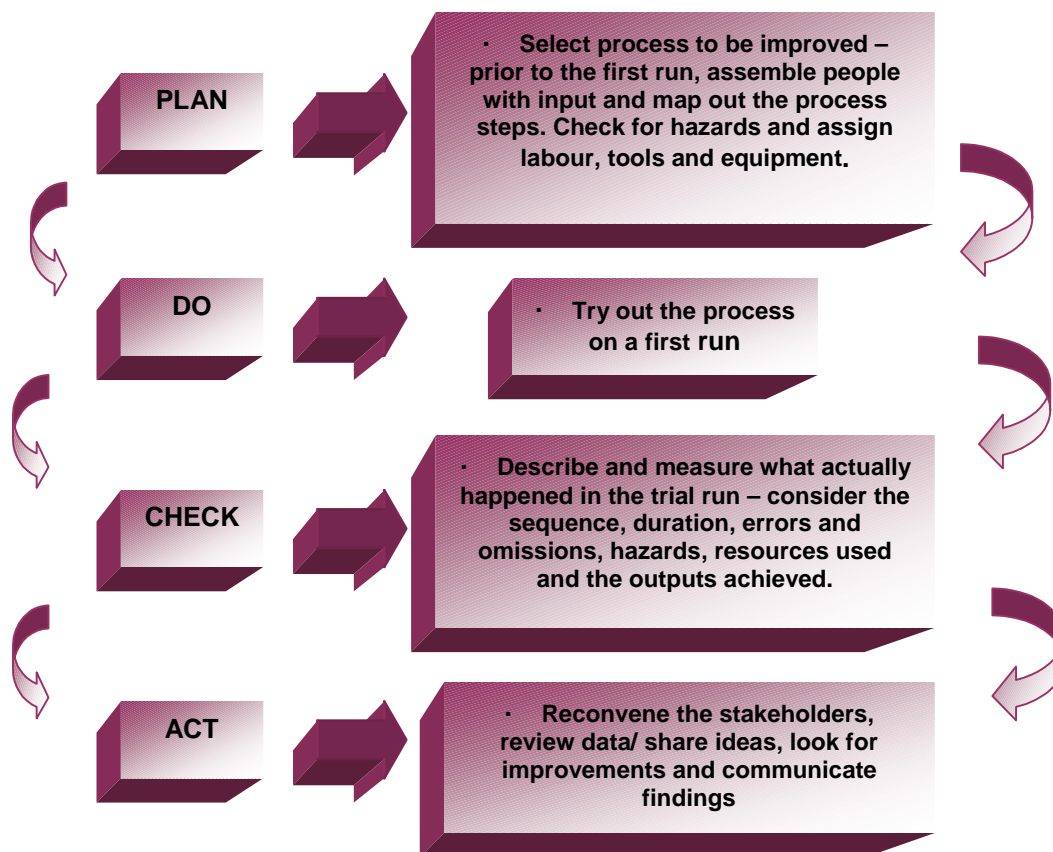
**Plan:** Select the process to be improved. Before the first run of each process, assemble the people with an input to make and map out the process steps. Undertake a brainstorming session to eliminate or reduce process steps. Check for safety, anticipate the hazards and problems and specify necessary preventions. Assign the labour, tools and equipment resources.

**Do:** Try out on a first run.

**Check:** Describe and measure what actually happened at the 'do' stage: process steps, sequences and duration; errors, omissions and rework; hazards; resources used; outputs.

**Act:** Reconvene the 'stakeholders' and review the data and share the ideas. Then look for ways to improve. Then communicate the improved methods.

Figure 6-3 Shewart's PDCA Cycle



As reported by ASIST, community projects that feature such participation are in effective use. Therefore there is every reason to use the PDCA procedure for unpaved road maintenance as a means of practical improvement. As for the broader concerns of reliable data generation, it can play a role there too.

The requirement for the 'big picture' in 'hard' quantified terms by administrators, donors and the like is a fact. What the Bottom-up approach, briefly described here, offers is greater reliability in the information that is fed into the 'big picture' or model that high level decision makers undoubtedly call for. It does so by rooting information capture (or data generation) in practice. It sets up modest change initiatives and monitors their effectiveness in terms of hard data, developed and used by those at the point of production. Such data are likely to be more reliable because they are tested in use, in specific circumstances with finite measurable outcomes. Data are a tool used by practitioners for *their* purposes. They are not seen, (as they usually are), as alien and for use by somebody else whose motives are distant and probably suspect. Such data can be fed back into the system for higher level use.

### 6.3 Application to Low Cost Roads

#### 6.3.1 Conditions and Stakeholders

If a third question of 'who benefits from local roads?' is added to the previous questions of 'who can maintain?' and 'who should maintain?', then the answer is likely to be the local community. But the application of a bottom-up approach cannot start with the local community, it must also work with and recognise the role of existing institutions such as the local district council and regional road authority. All of these key players or stakeholders must be involved in developing new ways of improving maintenance.

In practice the following conditions will need to apply if the bottom up approach is to have any chance of success.

- recognition by all stakeholders that the current arrangements are not working and are unlikely to improve
- the willingness and ability of the local community to be involved and take some responsibility for maintenance
- the agreement of the district council to provide support to the local community
- the agreement of the regional road authority to support both the district council and the local community
- a full understanding by all stakeholders of the roles, agendas, constraints and priorities of the group

### 6.3.2 Framework for Agreement

The stakeholders will need to agree on a framework within which action and change can be developed. The elements are likely to include:

**Table 6-1 Framework Within Which Action and Change Can Be Developed**

Funding	Agreement on whatever funding is available and its allocation for maintenance. Alternative sources of local funding should be considered either from the community or road users.
Ownership	The ownership of the road must be clarified in order to encourage community involvement. Cases have been identified where communities or users have taken action to maintain roads only to have the road authority reclaim the road and effectively discouraged such informal maintenance.
Responsibility	Is the community to take full responsibility for organising and carrying out maintenance or is its involvement to be limited to advising on maintenance priorities? Are local contractors to be used or a system of direct community participation by providing free labour?
Payment	Who will make any payments required? the community or district council? Who is to be accountable?
Training	Training will be required in basic maintenance techniques and the use of materials. Who will provide the training?
Equipment	There should be an understanding of what equipment is required and can be made available. Simple local equipment is preferred for basic maintenance.
Materials	The source and use of materials should be agreed
Maintenance Tasks	Which tasks will the community undertake directly and which tasks will be allocated to contractors? Will the district council or road authority undertake any tasks? What help will be given in emergencies?
Organisation	A community forum is required to agree the role of individuals or families and provide a point of reference and contact.
Maintenance Objectives	The aims of maintenance and the measures of achievement should be agreed, probably in the form of the level of accessibility that can be sustained.

### 6.3.3 Implementing the Bottom Up Approach

Once the framework has been agreed, implementation will use situational learning techniques such as PRA and lean construction as described in Figure 6-2 & Figure 6-3. Those who are involved in organising and doing the work must then meet to agree immediate tasks and methods and provide feedback on actual achievement.

The methodology of applying the bottom up approach to maintenance requires further development and its introduction will be aided by the provision of a facilitator. Facilitators should be local people who are trained in the concepts and respected by the community.

The development of the methodology and the training requirements of facilitators will probably involve trial projects. Experience of such projects involving other aspects of community life already exist<sup>12</sup>.

#### 6.3.4 Bottom Up Approach – Conclusions

The use of practical improvement as a *vehicle* for research has a respected history in anthropology and interpretative sociology. The main features have been referred to throughout this report in terms of 'situated understanding'. Its major feature is recognition of the difficulties of applying the objective/subjective distinction employed in the natural sciences. It stresses the role of shared and tacit knowledge (that is, what is simply taken for granted), in the process of understanding, interpretation and action. Where, as in the case of rural road maintenance in a range of highly specific circumstances, what can be taken for granted is uncertain and needs carefully to be learnt, we believe that this academic tradition is highly relevant.

It is said that *'Engineers and economists are seen to have most to contribute to the expeditious implementation of [development] projects, while soft social scientists asking awkward questions complicate things and slow projects down'*<sup>13</sup>. While this may be so, the present study has revealed issues which may benefit from slowing things down in order to do them more effectively with longer-lasting benefit.

To conclude - some questions, posed in this case by engineers, not awkward social scientists:

*'It is unrealistic to expect to make fundamental changes to the workings of an organisation in less than about ten years'*<sup>14</sup>. So why is it that consultants do not undertake projects of such length, is the problem simply that the donor organisations do not provide funding for sufficient lengths of time?

*'Concentrating solely on operation improvements in the field as has been the case in the past can have, at best, only limited success'*<sup>15</sup>. Why then persist with this policy?

The environment created by the arrival of consultants can be quite artificial and therefore sustainability can be a real problem. *'often there is polite acceptance of ideas or rationale presented by visitors from other countries'*<sup>16</sup>. This echoes the concern cited earlier with reference to the DIFD policy statement: what are more effective ways to make projects 'people-centred'?



## 7. RESEARCH LIMITATIONS AND FURTHER WORK

This research component, (Element A), was originally conceived as a direct result of a premise that maintenance manuals currently in use were not directed at situations where resources were limited, and therefore not applicable or appropriate for the vast majority of situations in which they were in use. It was therefore suggested that a review of current manuals and documentation along with interviews with “expert” practitioners would therefore identify deficiencies in current practices and instructional material and point to alterations that could be made to both the methodology and content of instructional material to make them more appropriate and effective.

This premise, that current instructional material was inappropriate to most low cost rural road situations, was based on the “traditional” view that poor maintenance performance was fundamentally due to mechanistic issues predominantly in funding, human resources, technical issues to do with maintenance and equipment. Based on this, it seemed that questioning “experts” who are actively involved maintenance of low cost roads would be the most likely source of enlightened information and insight.

Further, due to time and resource constraints, it was felt best to seek insight from countries where the maintenance of low cost rural roads was known to be a problem. As a result the vast majority, if not all, of the information gathered was from countries where resources were limited and maintenance regimes for low cost roads were not working. The inclusion of some countries where low cost road maintenance was working may well have provided additional valuable insight, and possibly many more solutions rather than the problems that dominated our findings. This research and global knowledge could therefore benefit from subsequent in depth analysis of situations where low cost, road maintenance regimes are working. This would hopefully allow suitable options to be adopted elsewhere.

The findings were also dependent upon the interviewees and in hindsight a different set may have been chosen. The interviewees have all come from within the road sector, and yet our research suggests that systems, solutions and alternative options have to come from within the greater community that the roads serve. Again this suggests that the research, and resultant findings, are limited as they only represent views and opinions from one part of the equation. For this research to be more complete, subsequent complimentary work is required within the rural community and user societies.

This research has highlighted the need to adopt more socially oriented research methods to capture the significant social nature of the problem. The research has identified the SODA approach and cognitive mapping in particular, as a useful and appropriate technique to capture many of the nuance’s of a complex, dynamic and socially oriented situation environment that is invasive of the “Third World”. Other Management Science / Operations Research methodologies should be reviewed as a possible source of alternative techniques that may be of assistance in developing alternative low cost rural road maintenance regimes.

It is clear from the cognitive mapping exercise no single solution will be found to fully address the issues raised by interviewees, and that each circumstance will require its own custom solution. The solution must be “home grown” and derived from a comprehensive process of understanding, consensus and commitment. External assistance will always be required to introduce new ideas and concepts and to help facilitate the development process. However as greater understanding of the local culture and environment, more effort will be needed to capture local nuances and structure local needs, perceptions and capacities before any planning / co-operation planning is undertaken. To achieve this we would recommend that research be undertaken. To achieve this it is recommended that research and development be undertaken into techniques such as PRA and lean construction so that they can become suitable tools to help both local communities, headquarters managers, facilitators and expatriates communicate effectively in this mixed environment. This would assist in the process of undertaking comprehensive stakeholder analysis, an essential forerunner to any planning and programme development initiatives.





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## Report I - Appendix I Addressing Maintenance Effectiveness

# Appropriate and Efficient Maintenance of Low Cost Rural Roads

## Report I - Appendix I Addressing Maintenance Effectiveness

February 2000

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## REPORT 1 ADDRESSING MAINTENANCE EFFECTIVENESS

### APPENDIX I- INTERVIEWS

#### 1. INTRODUCTION TO THE INTERVIEWS

As part of the project entitled: "Appropriate and efficient maintenance of low cost roads in developing countries", a number of interviews were undertaken during the period October 1997 to July 1999 with people who were involved with road maintenance in developing countries. Interviews were undertaken in a confidential manner, and the comments made by respondents have therefore not been attributed to specific people. The purpose of the interviews and associated work was to establish the framework within which maintenance is undertaken and therefore to understand the constraints to undertaking effective maintenance. The comments of respondents are split under relevant categories, such as materials, equipment, funding etc for ease of reference.

The following report is a record of the information gathered regarding the framework of constraints surrounding maintenance. The comments were made by a variety of experts from developing countries and also overseas consultants. Pertinent comments and quotes have also been taken from relevant documents in support of the research.

It should be noted: where information is presented in a box in "quotation marks" it is a quote taken from an interview, relating to a particular country and/or subject. Where information is presented in a box, without quotation marks, it relates to a specific country but is not a direct quote, and was therefore observed through an interview or site visit. Where information is presented in *italics* it is a quote from a paper, book etc. and is cited accordingly. The shaded boxes are quotes of special interest.



## 2. THE 'FRAMEWORK' OF CONSTRAINTS

*'Many examples exist of development projects whose design has been based on wrong assumptions or erroneous definition of the problem. Care and attention spent in identifying the problems to be tackled, therefore, can have a useful payoff'.<sup>1</sup>*

The causes and effects of maintenance, and their connections are important. Is the core problem that 'low cost roads cannot be maintained?' Why?.....because there is no capacity. Why is there no capacity?.....because there is no money! Why is there no money? etc. etc. Or perhaps the people living in the community can't use the road, so perhaps that is the real core problem. An expert commented: "With regard to the poverty angle, what is the link between the road and poverty? If an area has no agricultural potential, and the potential for work is some 20km away, the problem is compounded if the bus won't go down the road, and the people can't get to work". Perhaps these are the key issues. The situation is obviously very complex, yet it is the framework, and it is the real situation.

The following sections provide insights into some of the constraints, and they have been split into separate issues – together they form the framework within which maintenance is undertaken. The following table lists many of the constraints:

**Table 1 - Maintenance Constraints**

Equipment	Funding	Organisations	Attitudes	Rural roads	Materials
Lack of skilled operatives	Seasonal influence on budget, (or lack of)	Force account – is the system efficient	Of Road users	Community participation in maintenance	Lack of materials
Spare parts	Lack of funds	Existence of skilled contractors in the country/ region.	Of Engineers	Poor access for rural communities	Inability to assess suitability
Storage	Improper use and corruption	Inefficient organisations	Of Communities	Seasonal road closures/ access	Haulage problems
Workshops	Systems used to budget	Staff Issues	Of donors	Ownership issues	Cost
Costs	Regularity of allocations made	Motivation and employment	Of consultants	Effect on economic development	Testing facility
Concept of value	Amount of funding	Training	Of politicians	Issue of IMT	No crusher
Foreign equipment due to the difficulty in obtaining local equipment	Emergencies – how to pay for them	Remuneration	Involvement of other ministries	Agricultural effects on drainage – obtaining a balance	No roller
Transport problems for staff	Raids on funds by other ministries	Manuals	Lack of 'glory' perceived in maintenance	Development of infrastructure	No bowser
Concept of equipment maintenance	Systems used to prioritise funding	Policy	Acceptance of technology		
Equipment training for staff		Reluctance to adopt new practices.			

<sup>1</sup> IT TRANSPORT LTD., Promoting Intermediate Means of Transport, Approach Paper, Oct. 1996, SSATP Working Paper No 20, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p3.



### 3. MATERIALS

A problem, which relates back to the knowledge of the supervisors and their experience, can cause problems with regard to materials and how they are used.

#### Country U1

"It is now becoming difficult to obtain good murrum, as those people who have good sources on their land tend to sell it and the district cannot afford to buy it. They feel it is usually better to do nothing to the road, rather than undertake regravelling etc with poor murrum. They charge 30,000 Ushillings for a trailer containing 3.5 cubic metres of murrum. It makes it difficult when extra material is needed to shape the road".

#### Country B1

A respondent pointed out that a severe lack of materials understanding by the engineers and supervisors compounded the problem of mis-use of materials. This was due to the fact that without the right testing, it relied on the judgement of the supervisors to ensure poor quality material was not used. As there are no local courses to train people, the problem is further complicated. Additionally, there appear to be no independent checks carried out on the contract work, with consultants often trying to carry out the lab tests themselves. It is not hard to imagine the possibilities for bias. It is somewhat ironic that the MoW does not have a crusher.

#### Country F1

The design of flexible pavements in the country is based on a sub base and base which are unbound and a thin chip seal surface of say 50mm. The surfacing does not provide any structural benefit to the road, and this instead comes solely from the sub base and base. Gravel roads are built in the country – a clay binder is used with a 10mm graded stone layer for the running course. The PI value of the base allows the surface gravel to 'stick'. The material used for regravelling etc is not always tested as the judgement of the supervisors at depot level and the engineers at the divisions is felt to be sufficient.

The engineer pointed out that most of the gravel roads in the country have not been engineered or designed. They would have originally started as earth roads, or alternatively would have been brought about by having the topsoil removed and some sub base and base placed on the subgrade. Formation levels and widths would not have been designed, nor would camber and drainage. There are no earth roads, due to the large amount of rain in the country, which would quickly reduce an earth road to a slippery surface.

The specifications used for materials are based on the PWD Standard Specification for Road Works and Bridge Works – Technical Specification 1995 – Series 300 – Pavement. Requirements for natural gravels and crushed rock are given as follows<sup>2</sup>:

**Table 2 - Requirements for Natural Gravels**

Property	Base	Sub base
LL % maximum	35	35
PI % minimum	2	2
PI % maximum	6	12
CBR % minimum	80	30

<sup>2</sup> Adapted from PWD Standard Specification for Road Works and Bridge Works – Technical Specification 1995 – Series 300 – Pavement, p301 (2 of 4).



**Table 3 - Requirements for Crushed Rock**

Property	Base	Sub base
Sand Equivalent minimum	50	-
LL % maximum	30	40
PI % maximum	2-6	2-12
CBR % minimum	80	30
Flakiness Index maximum	35	35

Grading requirements for different types of crushed rock are given. The thicknesses for the layers of the pavements are apparently not actually written down anywhere, but are generally 150-200mm of sub base which can be a coarse river gravel type material passing a 75mm sieve, then a 100mm minimum base layer which is a crushed material. Many of the depots benefit from good gravel sources, such as river gravels. However some depots have to import material from other areas which results in extra costs.

Country L1  
 "Material is a major problem, due to a shortage of good quality gravel, without a crusher the oversized material causes a problem. Paving is becoming a more favourable option for this reason. Steep gradients mean that material loss is increased. (Due to the mountains)".

**3.1. Laboratory**

An issue, which leads on from that of materials, is the testing facilities and how they are equipped and operated.

Country B1  
 It was questionable whether or not the equipment was calibrated and therefore the accuracy of the tests could be in question. It was reported that when equipment broke down, it was often not repaired as overseas parts or expertise would be required. Surprisingly, there was a CBR machine which had never been used, indicating possible under-utilisation of some equipment. A budget is given to run the lab and they can undertake work for private consultants. However the revenue earned, does not actually benefit the lab, as it apparently just gets added to the government pot.

#### 4. EQUIPMENT

*'The spectacle of expensive equipment fleets sitting idle for want of a few spare parts, competent mechanics, fuel or other complementary resources - with associated labour forces also idled (but nonetheless continuing to burden the public payroll) - is all too common'.<sup>3</sup>*

The constraints to maintenance include many factors that are intrinsically linked, and can be very difficult to separate. *'The level of maintenance achieved on any road is mainly a function of the allocation or availability of staff, fuel and equipment'.<sup>4</sup>*

The issue of equipment is always a favourite subject of many people involved in maintenance. However, it is perhaps one which has less of an effect at the bottom end of maintenance, especially if community maintenance is considered. Perhaps it is sometimes an excuse to blame the poor maintenance record of organisations on the equipment?

*'Low availability of equipment is a major contributing factor to the performance of direct labour'.<sup>5</sup>*

*'Developed countries strive to mechanise all forms of maintenance because labour is expensive and productivity can nearly always be increased if modern equipment is used. In the case of developing countries, the opposite is usually the case. The equipment and its operation are proportionally more expensive than labour which is cheap and freely available. In addition, equipment is nearly always imported and represents a drain on scarce foreign exchange resources. Thus maintenance of unpaved roads offers scope for using labour, and it can be highly cost effective if labour rates are low, plant availability is low and plant procurement expensive'.<sup>6</sup>*

The issue of centralised equipment divisions is a good example:

Country N1

Equipment is supplied by the Heavy Equipment Division (HED), it is not uncommon for equipment to be out of service for long periods due to the lack of spare parts, thus causing problems such as "having to compact patching material without a roller". There can be problems with obtaining equipment from the HED, as the divisions in the region are all likely to request equipment at the same time, this is compounded by the lack of programming and the seasonal conditions which affect when it is suitable or possible to carry out works. The problem of insufficient vehicles available to the division staff was noted, this is a particular problem in the hills. It would appear that most of the divisions do not have any computer facilities.

<sup>3</sup> HARRAL, Clell. G., World Bank experience with highway maintenance: time for new directions?, The World Bank, p131.

<sup>4</sup> JONES, T. E. & ROBINSON, R., A study of the cost effectiveness of grading unpaved roads in developing countries, TRRL RR 91, 1986, p1.

<sup>5</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p35, C3.

<sup>6</sup> JONES, T. E., The Kenya road maintenance study on unpaved roads: optimum maintenance strategies, TRRL LR 1112, p17.

**Country F1**

In general the plant pool is not well stocked. The depots are provided with plant by the plant pool, and hire charges are paid by the depot. The equipment is generally over 15 years old and breakdowns are very common. The depots reported that it was difficult to keep to the programme of work, due to the equipment problems. If the plant pool is running short of equipment, the depots are allowed to hire from other sources and sometimes the hire charges were less. The supervisors from the depots felt that new equipment would considerably improve the situation. However the latest Upgrading Project, funded by the ADB, did not allow for the purchase of new equipment.

**Country U1**

An interview with a respondent revealed: The district has the following equipment:

1 bulldozer, 1 motor grader, 2 tippers, 1 tractor trailer, 2 pick-ups and a vibrating roller and wheel loader. A mobile workshop is used to undertake repairs. There is no proper workshop, so the MoWTC central equipment division is used for major repairs. For a district situated a long way from HQ, this poses significant transport problems. Four inspectors monitor the condition of the road at least twice a week. The vehicles used by the district are one pick-up for maintenance and one for rehabilitation work, 1 motorcycle for the assistant engineer and the four inspectors use bicycles, (thus making it difficult for them to get around).

**Country U1**

An interview with a respondent revealed: Equipment poses a significant problem, particularly due to corruption within the workshops. The DCE pointed out that they pay for new parts to be fitted to their equipment, but they find that second hand parts have been fitted and the money pocketed. They had tried contracting out their repairs to local garages, but it had not been effective. The corruption within the workshop is due to low pay and monitoring of the mechanics is difficult. It is planned to sell off the equipment when the new contracting system starts, presumably a small amount will be kept to undertake emergency works.

Equipment to monitor road performance is not available and this appears to be due to the lack of understanding by the councillors who control the council. When they are told that money is required for particular activities to do with road maintenance, they do not see the relevance. They therefore have to be educated, and some do not appreciate the need for maintenance at all, let alone monitoring and condition assessment.

**Country Z2**

"In two particular countries, when plant is broken it is a major problem. The plant has to go to the central equipment division for repair. Vehicles for the staff to get around in are not freely available. In one of the countries they have privatised the equipment division and they now hire equipment from them".

## Country U1

An interview with a respondent revealed: Fuel for the vehicles is procured centrally and sent on a tanker to the station. Therefore they cannot buy their own fuel and if they run out, they have to request more from HQ, (a days drive away) and delays mean that the equipment cannot work. If repairs to equipment are needed it can mean that less fuel is provided to make up the cost. The district has the following equipment: 2 graders (one of which is at the central works for an overhaul), 2 tippers, a roller, pedestrian roller, and the motorcycles for the overseers. There has been an equipment problem for the past 5 years and the engineer felt it was his biggest constraint. (Quite surprising as the problem with financing seemed far more significant to the outsider). The equipment is 10 years old and there are many breakdowns. They can fix some problems in the district, but otherwise they have to transport the equipment the long distance to the MoW HQ. Repairs have to be estimated and a request sent to HQ.

## Country U1

"The equipment owned by the station: 2 motor graders, (with serviceability at 30%), a wheel loader, a pedestrian roller, a towed roller, (but there is no tractor to tow it), 3 tippers, a flat bed truck and a fuel tanker. Cash is received to carry out minor maintenance on vehicles, this covers fuel, lubricants, grader blades etc. The fuel received (by tanker) tends to be only 50% of what is actually needed. If the district feeder road engineer has an emergency then an agreement is made over the supply of the equipment, help is especially needed by the district feeder roads office to undertake large works. Most problems tend to hinge on money, as further financing would allow better equipment to be bought and fuelled. For example the delivery of fuel is not regular due to irregular releases of money from Ministry of Finance".

When vehicles are provided as part of projects, it is interesting to note that misuse can take place:

## Country U1

It was mentioned that the Road Inspectors had no transport making it difficult for them to visit sites. They were provided them with transport as part of the project, but some misuse did take place. The environment was difficult to work in, for example the lack of equipment and the fact that the districts did not want to share, meant that a pool of equipment on a regional basis could not be used.

## Country S2

"Central equipment divisions allow sharing to take place, but when the use is not programmed, problems arise, the problems are compounded by a lack of appreciation of the importance of the equipment, unskilled operatives and general misuse. Lack of equipment can be a problem, yet it is not because there is not enough equipment in general, the problem arises when the equipment that does exist, breaks down or is broken through misuse and neglect.

## Country M1

"The contractors often do not have the capacity to undertake the work, they have no collateral, they cannot raise the bonds and they do not have any equipment or the money to buy it. It is also very difficult to hire the equipment as there is insufficient equipment in the country. Even the central equipment division have not got enough equipment (especially as much of it has not been maintained). Even the large contractors have trouble obtaining plant".

#### 4.1. Spare Parts

A respondent stated "In some countries, it is easier for a project to have 12 tractors, (i.e. spare tractors) than it is to have to go out and mend punctures. Spare equipment, not spare parts".

A problem which leads on from equipment, is obviously the corresponding lack of spare parts: *'The main complaint of the superintendents was the inexperience of the plant operators and the lack of suitable spare parts.'*<sup>7</sup>

*'It is important to realise that, by using less complex equipment which is less reliant on imported spare parts and foreign exchange constraints, the desired maintenance is far more likely to be achieved.'*<sup>8</sup>

*'Much of the equipment used by the divisions has been taken over from former construction projects, as a result, many different vehicle types/ makes are used. The HED cannot stock all the parts, as a consequence repairs can take months to years.'*<sup>9</sup>

#### Country B1

Each MoW district has a workshop, which stocks spare parts for the vehicles. Despite this rather impressive system, the fact that the vehicles are usually foreign, means that when they do breakdown, and the required spare part is not available at the district or the main workshop, then the parts have to be obtained from overseas, and the usual waiting around occurs. Fortunately however, most of the parts can easily be obtained from the US, and the turnaround time is therefore not too excessive. Apparently, each district has roughly two graders and the work of the graders is programmed, (as is other equipment). Indeed, it would appear that the districts will sometimes even share equipment, providing the fuel and operator time is paid for by the borrowing district. Such a process is organised between the Zone Engineers. When asked about his workshops and equipment, the respondent gave a wry smile and stated that he didn't have a roller, "well I suppose I have an excuse for a roller". Therefore the gravel roads built are not rolled. If a district wanted to buy new equipment, it would have to apply direct to the Minister of Finance. It is very unlikely that permission would be given, and no equipment has been bought for quite a while. Contracting is becoming more common, which takes the equipment pressures off to an extent. Machinery is utilised fully, but there is a shortage of some types of machinery.

*'The availability of any item of plant in developing countries is affected considerably by the availability of spare parts'..... 'The problems are exacerbated as often few of the appropriate spares are stocked because of their high cost'..... 'Tractors and towed graders also require a lower level of mechanical expertise than motor graders for both minor repairs and overhauls.'*<sup>10</sup>

<sup>7</sup> JONES, T. E. & ROBINSON, R., A study of the cost effectiveness of grading unpaved roads in developing countries, TRRL RR 91, 1986, p2.

<sup>8</sup> JONES, T. E. & ROBINSON, R., A study of the cost effectiveness of grading unpaved roads in developing countries, TRRL RR 91, 1986, p4.

<sup>9</sup> Strengthened maintenance divisions, Phase 1, July 1994 to June 1998, Project Document, Aug. 1994, p6.

<sup>10</sup> JONES, T. E. & ROBINSON, R., A study of the cost effectiveness of grading unpaved roads in developing countries, TRRL RR 91, 1986, p3.

## 5. FUNDING

*'One contributing factor affecting effective road maintenance is the changing value of the local currency which makes budgeting of maintenance works and the acquisition of foreign resources rather difficult. Other factors include low availability of materials, equipment and vehicles and delays in the release of funds'.<sup>11</sup>*

Opportunities for increased funding for maintenance in developing countries is small, and therefore the most efficient and appropriate use of the available funding, through the appropriate utilisation of local materials, labour, simple tools and techniques is of paramount importance.

*'The problem of maintenance is not just that of low productivity due to lack of funds, but is usually a combination of inefficient management, inappropriate plant and techniques that will not necessarily improve if more finance is available...better usage of whatever resources and funds are available...(is required)'.<sup>12</sup>*

*'Funding, and the capacity to use the funds efficiently, should go hand-in-hand'.<sup>13</sup>*

A respondent stated:

Giving money to countries is completely irrelevant, the money must only act as a bridge, a percentage that comes on board from local resources. If they can't afford to maintain the roads they shouldn't be built, but the inheritance from the colonial era is that networks were built up (that were not necessarily required), as money was thrown in to the countries. It is a complex issue.

*'It is interesting to note that since the previous restructuring of the Department in 1993, the annual roads budget has increased from NR2,763 million to NR4,698 million - a 70% rise with no practical change in the organisation. Under these circumstances, it is then not surprising to learn that some 30% of the maintenance budget for 1995/96 was returned to the Treasury and on average, only 27% of available project funding is utilised within the allotted time-scale.....The problem of road network management in Nepal is therefore more institutional than financial'.<sup>14</sup>*

The following information is extracted from (Heggie and Vickers 1998, original source: Survey of country road agencies, World Bank sector project reports, and World Bank task managers), and demonstrates the shortfall in maintenance funding for Main and Secondary Roads in a selection of countries<sup>15</sup>:

<sup>11</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p32, C1.

<sup>12</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, A thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p5.

<sup>13</sup> MRCU, Phase 1 completion report Apr. 1997 HMG/N ~ MRCU, p16.

<sup>14</sup> MRCU, Phase 1 completion report Apr. 1997 HMG/N ~ MRCU, p44.

<sup>15</sup> HEGGIE, I. G., & VICKERS, P., Commercial Management and Financing of Roads, World Bank Technical Paper No 409, 1998, p23.

**Table 4 - Shortfall in Maintenance Funding for a Selection of Countries**

Maintenance expenditure \$m	Chile 1995	Ghana 1996	Hungary 1995	Kazakhstan 1996	Korea 1997	Pakistan 1995	South Africa 1995
Required	760	135	240	176	970	40	742
Actual	308	73	127	101	655	27	507
% received	41	54	53	57	67	68	68

**Country P2**

There used to be a block grant given which covered wages etc. The allocation used to be high, but now things are much tighter, the cutbacks have made the situation quite different. The Provinces send their condition assessments of the network to Headquarters, who take care of the programming and planning. There is a quarterly release of money. The allocation now tends to be say 20% of the bid.

“As a result of the economic difficulties experienced in PNG over the past few years there has been very limited and inadequate funding for roads maintenance. This year the department has requested 100M units, but has been promised only 32M units, which only covers emergency works. In fact extra money is needed for ‘catch up’ maintenance because of funding deficiencies in preceding years. Proper maintenance management is not possible under the current circumstances, when receipt of funding is not guaranteed and the allocation is so small as to eliminate almost all activities except emergency repairs. Also, some difficulties are being experienced with the current MMS....spreadsheets for budgetary planning are being sorted out until the system is upgraded. The department is reliant on tied aid from AusAid and ADB”

“Funding for road maintenance has been very unpredictable and inadequate in recent years, which has made maintenance management and planning extremely difficult. The funding agencies have been moving away from sponsoring capital works and have taken a greater interest in road maintenance during the last few years. The allocation of 32M units will be supplemented with aid funded maintenance and rehabilitation works”.

“In recent years the province has had a very limited Government allocation for roads maintenance. During 1997 there was no 4th quarter allocation. To date no funds have been received for 1998. As a result, there is no work in the province apart from that funded by AusAid and ADB. The province has only one patching crew and grass cutting is limited to corners at present”.

“Programming of road maintenance in recent years has been very difficult due to uncertainty regarding budget allocation. In 1997 no final quarter balance was ever received from the Department of Finance. The requested budget for 1998 was 110M units and this was cut to 40M units and it is now believed that a budget of 32M units has been approved by DoF.

**Table 5 - Comparison of Proposed and Approved Budget**

	Requested or proposed budget in M units.	Approved budget by DoF in M units.
DoF	40	32
ADB	14	8
WB	15	10
AusAid	> than approved	7
	Total	57

Although the AusAid money is a grant the DoF will not approve more than 7M units because this reaches their ceiling. The Department is being encouraged to move from the use of day labour to contractors for maintenance, but the uncertainty of funds makes it difficult. The current system of Provincial Works Departments and Plant Pools is felt to be appropriate. In remote sites there is no alternative, where commercialisation is not practical because of high establishment costs for contractors”.

#### Country A1

“Funding is always the issue, and funding is a product of politics. Most funding for unsealed roads comes from Local Government. Aggregate local government funding for roads has remained static in real terms since about 1982”.

A respondent commented:

“Almost all of the money goes on extending the road system and almost nothing on maintaining what is already there. Aid programmes in the country often get cancelled. At present the World Bank have a \$50 m project and it is just coming to the last year with only \$25 m actually spent, (4 out of the five years have passed and only half the money has been spent)”.

A respondent commented:

The force account system is better as it ensures local people benefit from the work undertaken. Local people are employed and paid a set amount. The minor contractors do not pay the local people fairly and thus the local people receive less benefit from such a system.

#### Country Z2

“The allocation for maintenance is normally 40 -50% of the amount bid for. (That has been the case for the last 5 years). The Chief Engineer will get involved in checking the bids and programmes forwarded by the provinces. The Ministry of Finance and financial people in general do not understand the type of planning and programming which is presented as part of the maintenance bids. The MoF will often allocate the budget very differently to the bid, making it necessary for the Engineer to justify and demonstrate any necessary re-allocations of funds, which then have to be re-approved. Due to the short fall in funding, ‘fire fighting’ is all that can be achieved. Routine maintenance such a grass cutting and drainage maintenance are carried out, but little else besides. The budget allocation does increase each year, but whether or not the increase is in line with inflation is another matter”.



## Country Z2

"If there is insufficient money to carry out the maintenance, then organisations are not keen to allocate money for surveys etc. If a country is only receiving 50% of the required budget, then the tendency is to use it for 'fire fighting' and the gathering of data for a MMS is not carried out. Donors do not have very much input on maintenance funds, therefore governments are free to distribute funds as they wish. Road Boards should help to alleviate the problem".

## Country L1

"There is just about sufficient money available for maintenance, however, a recent highlands water development fund, has built 800-900km of roads with revenue from water supply to a neighbouring country, therefore the maintenance bill will go up as a result. The roads were built through consultants and contractors. Most of the periodic maintenance and rehabilitation work is covered from loans".

"A road fund and road board is now in operation (1st year operational) and it is intended to pay for periodic maintenance and eventually to pay for routine maintenance too. The World Bank are keen to develop Road Authorities with a team of engineers/ managers. The country is therefore in a transitional stage, as are many other countries".

*'...the problem with the roads sub-sector in Nepal is not so much a lack of resources as the inability to use available resources effectively'.<sup>16</sup>*

## Country U1

"The emphasis is to move away from force account works. The fleet of old equipment can then be scrapped, or the contractor will be allowed to hire the equipment if he repairs it. Contracting is a far more effective way to operate, especially with regard to the equipment problems which the stations have faced. With a force account system, the regular equipment breakdowns mean that work has to stop until the repairs have been completed. However, contracting means that extra staff are needed for supervision, and this is currently the problem area. There is a lack of incentives for staff, the allowances are insufficient, and the overseers have to rely on inadequate transport".

<sup>16</sup> MRCU, Phase 1 completion report Apr. 1997 HMG/N ~ MRCU, p29.

## Country U1

"In the City Council (unlike other urban councils) there are many, many complaints from the public regarding the condition of the road. KCC is however trying to change it's image and revenue collection is being targeted. The DCE stated that force account was not a good system. He gave an example that under the force account system 60 million Ushillings had been spent on grass cutting, gulying and road sweeping, yet under contract the same amount of work had only cost 26 million! Many staff had been retrenched in the transition from force account to contracting, and there had been a number of costs associated with this. However the DCE felt that the costs could be recouped. In the force account system, the staff were supposed to work from 06:00 to 17:00, however many only actually worked 4 hours and they got away with it. Obviously the same thing does not happen under the contracting system".

"The idea is to go over to term maintenance contractors and the system should be in place by the next financial year. Rates will be used and these are currently being developed. An approach will be made to contractors held on a list to undertake particular tasks as required. At present all the maintenance work is undertaken by tender, which is a slow process. Anything over 1 million Ushillings has to be tendered under MoLG policy. The Local Government do not like the idea of 'selecting' contractors, which is exactly what will happen under the term maintenance contracts. Their concerns stem from corruption, but the current methods of tendering all work is cumbersome and long winded. It is however only an interim measure between the old force account system and the forthcoming term maintenance contract. The restructuring and change of emphasis on service delivery will mean that recruitment will have to be undertaken to supervise the contractors. The council maintains 600km of roads, with 390km being paved and 210km being unpaved".

"Resources for the council are a real problem. Money comes from taxes, buildings, trading licences, fuel, road licences etc. and go into a pool and all the ministries benefit. The DCE did not think this was a fair system, as 80% of the vehicles in the country are in the capital, but they do not get a share of the revenue which reflects the actual situation. Roads receive approximately 6% of the budget, whereas they actually need nearer 30%. The whole department gets 24% but this covers refuse collection and other items not directly related to roads".

## Country S2

A respondent commented: "The recurrent maintenance budget has generally been underspent by about 20 percent for most of the past five years I understand, and this has been attributed to lack of staff. Recurrent budgets have been in the 25 to 30 million Rand range. In Fiscal 1997 this situation changed and we overspent by almost ten percent, which is causing some difficulty with our present planning because the financial people are saying that the overspending must come out of our present recurrent budget (our financial years run from April to March), for which a request for R 42 million was submitted last December but which was arbitrarily cut by Finance to 27 million. Fiscal planning and management, either in the RD or the Finance Ministry, is not our strong suit I'm afraid! We don't seem to have an official organisation chart, and the ones which our TA has submitted for consideration have gone into Limbo without any response from RD, so it is difficult to know who does, or should do, what. These things sound ridiculous in the developed world but are quite normal in my experience in parts of Africa and Asia, especially in the smaller countries".

"I feel strongly that the reason for this is cultural, despite it being politically incorrect to say so, and that the only cure in each country will be for it to go through a period of hardship such as has been experienced in New Zealand in the 80's, in UK under Thatcher and in some parts of Asia currently until some idea of a fair day's work for a fair day's pay is established. This notion is simplistic I know and yet I'm afraid that I believe in it as being akin to the process of natural selection (if you saw what happens in this agency daily you would believe in it too!)"

#### Country C1

"There is a big problem in the rural roads financing program in the country. It has been a centralised country in which the National Government was undertaking all the expenditure to maintain the rural roads network for over 100 years. The new Constitution issued in 1991, established the necessity to decentralise many functions and give the responsibility to develop them to the regions. the rural roads network was not an exception of this new scheme. In fact, some National entities were fused and other disappeared to make the transference of roads faster. However, there was no a planned scheme which gave the regions a tool to develop new financial resources which allow them to continue with the maintenance expenditure (valorisation, tolls, user charges and fuel taxes) and then the scheme collapsed and now many regions want to give back the roads to the National entities".

#### Country M1

"The main problem with maintenance in the country is the lack of funding and the fact that the finance has been lacking for some years. From the early 90's the money allocated was less than 20% of that required to maintain the network. The network is some 15,000km, with approx. 18 or 19% paved. Much backlog maintenance now has to be carried out and this will probably be funded by donors".

#### Country M1

"There seemed to be an issue regarding the payment of rates, (which is where the revenue of the councils come from). There are many government buildings in the country and the government does not pay any rates for them. (45% of the buildings in the city are apparently government buildings, and as they do not pay rates on government buildings, that obviously means the councils receive much less money than they need). As a result the people within the community feel that they shouldn't have to pay until the government pay. The problem is exacerbated by the fact that the penalty for not paying the rates is actually less than if you put the money in the bank and earn interest on it. So it is quite normal for people not to pay. Resulting in a shortfall of money for the council".

## Country M1

The money from the fuel levy will not be sufficient to cover the required maintenance and the claims being made from contractors, and so the EU have noted this and will be providing funds to cover the claims being made against the MoWS (and now the NRA) by contractors who have not been paid in the past. (Contractors who were unpaid by the MoWS, felt that they should be paid by the NRA). (\$9-10M) being provided, but it will not cover all the claims. There is also a huge amount of back log maintenance to contend with. The network is also larger now, yet the funding for maintenance has remained static (due to the exchange rate) 1983/84 = \$7.2m and in 1998/99 = \$8.3m.

The fuel levy will not be sufficient to cover all the costs in the country and therefore it will have to be supplemented from other sources. The cost of collection will obviously have to be considered. The back log maintenance will be donor assisted, with contributions coming from the World Bank and the EU. A donor meeting could also be used to establish further donor pledges. The cost of the back log maintenance cannot be met from the road fund.

## Country U1

"The amount of money received by each district is very variable with some receiving 120% of the required amount and others only 19%. Basically there are just too many Feeder Roads and the classification (or lack of it) does not help. Getting the money spent effectively is a problem. Cutting grass is a very popular activity, there is not enough money to carry out maintenance on all roads in the district, so rather than prioritising they do a small amount on each. ROMAPS obviously aims to overcome such a problem. The donors are confident that the project will be sustainable, but not everyone agrees. If 9 of the 27 continue to maintain roads effectively then it could be regarded as a success".

## 5.1. Budgets

*'...budget growth in recent years has been accompanied by increasing under-expenditure. Government and private sector capacity, rather than funding, is therefore the limiting factor in implementing road maintenance'.<sup>17</sup>*

## Country B1

There is apparently not a satisfactory split between the definitions for routine and periodic maintenance, and as a result the funding and allocation is somewhat confusing. The money is allocated on a monthly basis and a carry forward is allowed, but not a carry over to the next financial year. The finance chief seemed to think that a quarterly allocation could be more useful. The problem then, is that the money is often not received until part way through the quarter, thus allowing less time to spend the money. The budget is not adequate to perform all the necessary maintenance operations, but perhaps this gives some incentive to be more efficient and innovative? The costs applied are not realistic in terms of overheads, equipment, materials and labour, with respect to the private sector.

*'...budget growth in recent years has been accompanied by increasing under-expenditure. Government and private sector capacity, rather than funding, is therefore the limiting factor in implementing road maintenance'.<sup>18</sup>*

<sup>17</sup> MRCU, Phase 1 completion report Apr. 1997 HMG/N ~ MRCU, p8.

<sup>18</sup> MRCU, Phase 1 completion report Apr. 1997 HMG/N ~ MRCU, p14.

Line item budgeting is apparently quite a common system of budgeting in developing countries: "It uses a system which means that instead of a rate being given for a job, i.e.: pot hole repairs in square metres = \$x (as in program budgets), a line item would be made up as follows: Under the annual budget, a lump sum would be received for, say, fuel, a lump sum for paint, a lump sum for spades, a lump sum for tyres, etc etc etc. The lump sum would then go to the department. It could be broken down to individual divisions, such as the ROADS division get 2% of plastic seat covers, but 40% of fuel etc.

Therefore if the engineer needs to repair a pot hole, a costing exercise would involve calculating the amount of fuel needed, how many men, how many spades, how many wheel barrows etc. (It is similar to making up an item for costing from first principles, except worse.

The estimate would then be submitted for a cut of the money from each "pool" or pot, and then each person bidding for money would have to argue their requirements with the fuel man, spade man and bucket man etc.

For one off maintenance activities it is not a good system as is it time consuming and

cumbersome. If the head of dept, received all the pots of money and had the labour gang for the year it would be easier, as the line budget controls the work force. However it is a very difficult system for external auditing as it gives information such as Mr X spent 87% of the fuel budget and 20% of his wages budget. Rather than saying he spent 50% of the pot hole repair budget.

#### Country F1

The periodic budget has increased very little in 10 years. Overspends do occur, and any under spend is lost in the system. Parliament sets the cash flow allocation, which is quarterly. The money is not always received on time – and it occasionally gets to the stage where payments to contractors (say) cannot be made. An example of the budget estimate for routine and periodic maintenance for the period 1981 – 1997 was provided, yet the engineer pointed out that the budget estimates given were realistic (based on what they thought was available and what they would actually get) rather than "pie in the sky" (based on what they actually need, but know they cannot get)<sup>19</sup>.

**Table 6 - Routine and periodic budget estimates**

Years	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97
Routine Budget Expenditure/estimate %	95	98	99	103	98	104	112	131	141	121	145	101	101	96	96	98	100
Periodic budget Expenditure/estimate												109	72	105	106	100	97

<sup>19</sup> Fiji Government of communications, works and energy, Annual Maintenance Report 1997, Series 1 – Historical, Appendix 10.7.2 –10.10

**Country F1**

A further demonstration of the shortfall in periodic maintenance money is demonstrated by the comparison between the lengths of roads resealed and rehabilitated, as compared to the targets<sup>20</sup>:

**Table 7 - Comparison of lengths of road sealed and rehabilitated**

Year	1994	1995	1996	1997
Target length of reseal	125 km	125 km	125 km	125 km
Achieved length of reseal	48.54 km	42.60 km	48.55 km	31.80 km
Target length of rehabilitation	45 km	45 km	45 km	45 km
Achieved length of rehabilitation	6.01 km	4.05 km	11.84 km	21.4 km

**Country F1**

With regard to the routine maintenance the split between labour, plant and materials for the money spent in 1997 was 58%, 29% and 13% respectively. The split between the different types of routine maintenance activities in 1997 was as follows<sup>21</sup>: Patching 23%; Drainage 18%; Grading 16%; Resheeting 18%; Sides 21%; Bridges 4%.

<sup>20</sup> Fiji Government of communications, works and energy, Annual Maintenance Report 1997, Series 1 – Historical, Appendix 10.8

<sup>21</sup> Fiji Government of communications, works and energy, Annual Maintenance Report 1997, Series 1 – Historical, Appendix 10.7.3

**Country U1**

The country has approx.: 16,000km of Feeder Roads, 2,000km Main Roads (all unpaved), 3-4000km paved Main and Town Roads.

"The budget for routine maintenance for the whole country was approx. \$4m, split between the 40 districts. Central Government gives money to the districts and the districts are supposed to match their allocation through revenue, but that often doesn't happen. Very little revenue seems to be collected and when it is collected it is used for other services. There is no penalisation for misuse, and as the collection system is not efficient, it is not a successful system. Probably about 10% is actually achieved. The budget is allocated as an unconditional allocation which covers wages, admin. etc. and a conditional budget which has a roads element. A few years ago the unconditional grant was insufficient to cover everything such as wages etc. and so the conditional money was used for those elements as well, thus leaving a short fall in the conditional budget. However, now the Government do give a sufficient unconditional budget allocation and so the money does not need to be borrowed".

"The allocation is made quarterly but often the money is not received at the beginning of the quarter. Due the allocation being made the late, the district often ends up using the money from previous quarters to undertake the routine maintenance". "If money has been misused then the district is penalised. The consultant advised the Ministry to cut grants to those districts who were misusing the conditional budget. Now that the consultant are pulling out, the hope is that the misusing of funds will remain a thing of the past, but there is obviously no guarantee".

General observations by respondent: "Line item budgeting makes the introduction of MMS very difficult and also makes it difficult for contractors to bid for work. The method of allocating the budget and the fact that a large proportion sometimes arrives in the last quarter, makes it difficult for the organisation to plan".

"Line item budgeting demonstrates a complete lack of trust, and a belief that nobody knows what they are doing. There are many reasons why such a system tends to be in place. Obviously, if the money allocated to a maintenance organisation is not spent, then it could feasibly mean that a hospital (for instance) is not built. Thus when systems collapse, those who are ultimately responsible for the money, (MoF) react by taking away freedom and imposing very strict methods so that the MoW can't make too many mistakes. To put right the problem, flexibility must be regained".

## Country U1

"The work force tend to say they have not got enough money, but in reality nobody who allocates money has confidence in their ability to spend. It is a chicken and egg situation, you really can't spend the money unless you have the resources and you can't get the resources unless you do have surplus cash. MoF tend to penalise too hastily those organisations who fail to spend, it is an issue that an MMS should tackle in the wider sense. The surplus cash must be allowed to sit there as an attraction to contractors, the contractors need to know that the organisation didn't manage to spend all of their money for the last year, therefore the contractor is encouraged to go to the bank and obtain a loan to buy a grader so that they can earn the money which the organisation has to spend. If the MoF do take away the unspent money and the contractor has gone to the bank and borrowed money to buy the grader, then he is in deep trouble - it is a viscous circle. On the other hand, if the money does sit there unspent, then a clinic or hospital that would have saved peoples lives, doesn't get built. Everyone has to fight their own corner".

"Some countries have a habit of promising say 12 million to the maintenance organisation and then allocating 1 million each in the first 3 quarters and then 9 million in the last quarter. Thus making it very difficult for the organisation to plan - cash flow problems are caused when money is received the end of the year, without leaving enough time to spend it".

## Country Z2

"The budgets are generally too small and as a result the money runs out part way through the year. In one particular country in Africa the network is 'falling apart', with the paved road network deteriorating severely in the last 8 years".

## Country T1

"The maintenance budget is allocated on a monthly basis, recently however, the monthly allocation had been received 3 months late! It is normal for only 30 - 50% of the budget to be received. A bid of 30 billion units had been made for last year and only 16 billion had been received. Due to the short fall in funding, the priority is 'worst first', but in addition to that the politicians obviously have an influence. The regions are required to list the roads which require maintenance in order of priority. Most regions do not have computers, so a quite basic system is obviously in operation".

## Country M1

The councils specify to the MoLG what is needed, yet the information is unreliable. However, the respondent admitted that there is no capacity to check the information which is submitted. The engineer distributes the budget, allocates funds to the roads in the order that they have been put forward by the local councils, and each road will receive an allocation until the money runs out, which is normally after the 2nd road on the list! The next year, more roads will be added and the priority placed on them by the councils may change, so that some roads are never actually maintained, as each year more important roads are added to the list. The budget is split by using a simple division of the budget/ number of councils. However, some consideration is given to the fact that some councils have got better roads than others and will not allocate as much to those.



## Country L1

"To overcome a possible short fall in the budget for maintenance, it has apparently been the practice to add 25% onto the budget, because the MoF always take off 25%!!, thus they can achieve close to 100% of what they require".

## Country M1

"The budget is split into planning, design, construction, routine and periodic maintenance. Then each category is split into activities and then again split to obtain a unit cost which includes everything except the salaries of permanent staff. If the allocation is not sufficient to carry out the activities required on a particular road, then the local level staff will decide how much of the road will actually be maintained with the money. The contracts are given in packages of 5/6 roads. The contractors have to be registered and pay a subscription. A big response has been obtained to the recent advertisements. However, due to the poor management skills of the contractors, approx. 50% of the potential tenders are likely to be discarded. (Information not supplied properly, breakdowns incorrect etc. etc)".

**5.2. Raids on funds**

[Robinson, R. 1986] *'The use of contractors reduces the organisational burden on maintenance departments and this system of working also reduces the possibility of maintenance resources being diverted to non-legitimate activities'*.<sup>22</sup>

## Country Z2

"One of the main problems in Africa is that maintenance funds have been raided. Rumour has it, that when the Cargo Airline in Zimbabwe ran into trouble two years ago it was apparently bailed out of bankruptcy using money from the maintenance fund! Politicians are able to raid the maintenance funds. Thus the idea of the Roads Board is to remove the funds from the control of the politicians".

<sup>22</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p34.

### 5.3. Corruption

An expert commented:

“Corruption is a major issue. The WB want to go towards the private sector to avoid corruption. In the private sector, it is easier to audit and check whether the work has actually been done. If the money has gone on direct labour doing the work it is very difficult to audit. Dead men on the payroll, on a payroll of 20,000, about 12,000 may only actually be alive. The muster roll system allows such things to happen. The money which is supposedly being paid in wages is then siphoned off all the way down the line. A force account operation means that if people do not get paid then they will shout, but if the roads do not get repaired and the villagers complain, no-one will take any notice. In theory, the private sector ensures people are paid for actually doing something, accountability”.

“The corruption comes on the percentage of the contract, and you do not kill the goose which lays the golden egg. Contracts are awarded, and the corruption is linked to delivery. It can still get totally out of hand, but the smaller contracts are less prone to it. A large project undertaken in an African country was awarded on a contract price which was inflated 3 times to allow the minister to take his 200%. Everyone knows about it! But in small contracts it is more difficult, but the problem for the small contractor is whether or not they are actually going to be paid at all, so work is currently being done on a system for the contractors, to encourage the formation of contractors associations, to give them a means of complaint”.

“Corruption is an institutional issue which has to be dealt with, but it is not directly related to low cost roads. Donor executed projects create an environment which is artificial. The building of government workshops, and the supply of spare parts is easy to deliver but is not sustainable. The advantage of investing in the private sector, is that in theory, when you leave, there will be something left. If the time was spent on paying for the engineers to go on overseas courses, it is a waste of effort. If you ask the engineers to comment on what they have learnt, they will say they have learnt very good things, but that have not been able to do anything with them, because they simply have not got the resources, which the course and teachings assume they have”.

A respondent commented:

"The divisional engineer is in post to deliver results, however, the engineer may also be in post because he bought his job from the minister, and therefore he owes a large sum of money to pay back the investment. The money has to come from somewhere. The minister bypasses all the bureaucracy and directly assigns people to jobs".

"A problem directly related to the budgeting process concerns the fact that individual roads are named, which encourages politicians to get involved. The politicians are always keen to get their particular road in the budget, even if it only has a small allocation, because once it is in they can come back and press for more money".

"Mishandling of budgets cause bureaucrats to add more and more layers of control to stop corruption. It doesn't stop corruption and generally just makes it more and more difficult to do the job. For every scandal a new rule is added to the system, thus making it even harder for the person trying to do the job. If you consider the department of roads, it should have a number of basic categories of budget, such as maintenance, new construction, safety program etc., i.e. several major deliverables that it runs its programs against. The top level of management should be spending their time checking whether they are meeting the targets. However, they spend their time on far more trivial things and the focus is not on delivering a core programme. At the next level down the engineer should be responsible for delivering his subset. However, there are many norms and rules which are used as a fall back, to say why the job wasn't carried out!".

Country U1

"Political pressure has a significant effect on prioritisation and as a result the politicians have been trained in seminars etc. The education which has taken place has been effective, but sadly the councillors who then understand what is required, are lost when the elections take place every 4 years and the whole process has to start again".

Country L1

"Nepotism appears to be a problem: I spent four years training 2 engineers to be proficient in the use of the PMS system, however they suddenly decided to leave, and at first I thought that it was because they were not earning very much, but one of the people involved actually admitted that the reason they were leaving was because they felt they would never be able to get any where within the organisation because they came from the 'wrong' tribe, e.g.: the tribe they came from was a different one from the Chief Engineer. I had been working with the people for 5 years before I was told of the problem". He went on to explain, "the tribe/clan issue had the following effect: if you were in the right clan it meant you had the opportunity to go on lots of courses etc. and you had the opportunity for promotion, and there was unlikely to be any reprimand for inappropriate behaviour". (A member of staff was sent on a course to the UK and he apparently arrived at the airport in such a drunken state that he was not allowed to fly!). "The problem of nepotism seems to be compounded in this particular instance by a Chief Engineer who doesn't believe in discipline, he believes that discipline should come from *'within the person'*".

## 5.4. Politics

*'...The very high demand for roads in the rural areas which has led to the increasing use of roads, under the multi-party system, as a political expedient to capture the electorate. These "political roads" are rarely planned or designed, they are often constructed at short notice, they have a limited life and often severe environmental consequences in the hill areas.'*<sup>23</sup>

The Nepal road system, comprising some 10,109km, is by any standard small. However, management of the system is governed by a unique set of conditions - high construction and maintenance costs, high risk of premature failure, low utilisation, and non-spatial economic development costs. In addition, some 4 million people in the hill areas have no access and the construction of rural roads is used as a means of political expediency'.<sup>24</sup> Political expediency with no thought as to the consequences of lack of maintenance seems all too common.

### Country B1

The Minister has apparently encouraged the district engineer to carry out more work in his constituency. The rumours are that he regularly turns up on site and gives the local engineer a plan of work that he thinks should be carried out in the week ahead. The respondent pointed out that politics take precedence at election time, he had been called that morning by the Minister and asked to carry out some works. At such times, it would appear that the program tends to 'go out of the window' somewhat.

Apparently, Ministers have recommended people for jobs in the past, but if the staff do not perform, they generally leave voluntarily. There is perhaps too much emphasis placed on new construction, with regard to Feeder Roads. They are often built to keep voting farmers happy. There is also too much unnecessary up-grading of roads.

### Country N1

Politicians have influence at all levels within the organisations, the influence apparently extends to the employment of staff at many levels. Therefore, inappropriate people could be placed in jobs. Staff can also be moved around if they prove to be particularly useful. The same problem occurs all over the world, but in a developing country which is trying to improve it's systems, the loss of key staff can send the whole process back to square one. Institutional factors caused by political influence should not be thought of as problems to be overcome and solved, but simply problems which have to be worked with.

<sup>23</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p11.

<sup>24</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p43.

*'Political influence in the activities of all divisions is immense'.<sup>25</sup>*

#### Country U1

"It was difficult to persuade the politicians that it is only worthwhile maintaining a road that is in a good condition. The politicians wanted the roads which were in a poor condition maintained and they couldn't understand why their roads were left out".

"The success of the consultants efforts will depend on the money available, perhaps 1/3 of the districts would be successful. Prior to the project, the politicians and the contractors believed that routine maintenance meant cutting grass only, and therefore that is what was carried out. The MMS has forced appropriate routine maintenance to be carried out. There was resistance from corrupt engineers and from contractors. The contractors now know what is expected. There is very little direct labour now, mostly contractors are used. Petty contractors carry out routine maintenance and small - medium contractors carry out periodic. Often International contractors would tender for the maintenance and would be 30-40 times over the engineers estimate, the reason being that there were not enough contractors able to undertake the work. Now however, through training, there are more able and qualified contractors".

#### Country B4

"There are approximately 12k of unpaved roads in the country, which are managed by the Central Roads Department and the District Councils".

"The funding is adequate, but it is never available at the right time. The technical expertise and the qualifications of staff can be a constraint, there are in fact a shortage of qualified engineers and the positions are more about politics than about engineering. The bureaucracy is a problem and the tendering processes provide constraints. The plant and equipment comes from an entirely separate department which causes problems with regard to obtaining the desired equipment. The roads division is required to give certain contractors work, regardless of their ability. Planning is a huge problem and there is currently a study of the institution being carried out".

#### Country Z2

"Political influence (usually at Ministerial level) often means that unnecessary upgrading of roads is common, even though resources are so scarce".

<sup>25</sup> HMG/N SDC/N, Strengthened maintenance divisions (Lalitpur, Bharatpur, Butwal, Pokhara, Lahan & Nepalgunj), Yearly plan of operation 1996/7, April 1996, p9.

## Country M1

"The National Road Authority is possibly the only hope for maintenance. The donors expect to see results in two years, which is possibly rather ambitious. Two rehabilitation projects have been offered as a 'carrot' if the NRA is set up and working. It is conditional upon the government sticking to the policy reforms. There is a lack of trust by certain ministers and this may be due to a feeling of loss of control. The MoWS can actually sack the board if they do not perform, but the indications are that it will work. Some cabinet colleagues are not in favour of a non-government organisation having control over so much money. A complete change of government could affect things, but probably not. The previous government would probably not have gone for the NRA idea. They would not have had the courage. Having key people within the authority will ensure it is effective. If people are recruited from the Roads Department to the NRA, it will be left with no capacity. Government used to rely on the number of people in post rather than what they actually did. The private sector expansion which is taking place at the same time as the establishment of the NRA will mean that professional people are hard to come by. With the local university only producing approx. 25 engineers per year the situation is unlikely to improve".

## Country M1

Decentralisation means that the Local Councils would become responsible for National Roads and possibly community roads. The raising of taxes would still have to be used for community roads. The National Roads Authority needs other sources of finance other than the fuel levy, such as overloading charges, vehicle licence, insurance etc. The NRA will work if the Minister does not interfere with the day to day running. There is some evidence of interference. But the road users seem keen on the principal of the NRA. The government has accumulated large debts with contractors. This has impacted on the NRA because the contractors are demanding the money they were owed and the NRA can't pay (and it would not be a good way to start). Funders therefore intend to pay off the bills, but there are still more debts. The MoWS may be merged into the Ministry of Transport, because it will only have policy left to administer. The future of the MoWS and the Roads Department is uncertain. There have apparently been stories of corruption in the papers, relating to the Ministers, which has not helped the situation in the country.

## Attitudes to maintenance

'Effective and enduring change is most likely to occur if the organisation realises the need for change, becomes committed to it and then develops the capacity for promoting and implementing change itself. This requires the organisation to take an increasingly proactive role in the change process from the very beginning'.<sup>26</sup>

*'...the consultants have adopted a process approach for which there are five controlling factors:*

*i) the process cannot be forced and is inevitably slow;*

*ii) the process must be promoted from within the organisation: it cannot be imposed from an external source even though external influences can create a context which requires and encourages change;*

*iii) the process must be flexible and adapted to suit the particular organisation: there are no ready-made solutions for institutional change;*

*iv) the process is organic: change in any one part of the organisation will have an impact on every other part; the process therefore involves the whole organisation, consequently, necessitates a holistic approach;*

*v) the process is not fundamentally logical: it is creative, it cannot be run to a fixed timetable and insistence on a logical approach will absolutely block the process for the time being'.<sup>27</sup>*

## Country U1

"A mentality existed in the country which did not help the quality of the work. Actual quantities are not measured because there simply is not time. Set working hours and size of gangs are stipulated. Road Inspectors do carry out checks, but the productivity is not directly checked, it was felt that people always got 'found out' eventually. For example: the motorcycles provided to some of the staff had to be impounded due to misuse".

## Country U1

"It was difficult to persuade the politicians that it is only worthwhile maintaining a road that is in a good condition. The politicians wanted the roads which were in a poor condition maintained and they couldn't understand why un-rehabilitated roads were left out".

<sup>26</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p23.

<sup>27</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p20.

**Country U1**

"The hardest thing to do was to change the mentality of people. For many years staff had often gone without wages, and so it is no wonder they didn't want to knuckle down. They had relied on corruption for a long time".

**Country S2**

"When a programme of work similar to the 'food for work' programme used elsewhere was suggested, the answer was a resounding NO!".

**5.5. Adoption of new practices and systems**

'.....Machiavelli's warning: "It must be remembered that there is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage, than the creation of a new system. For the initiator has the enmity of all who profit by preservation of the old institutions and merely lukewarm defenders in those who would gain by the new one".<sup>28</sup>

It would be interesting to see just how many systems have been implemented in various organisations, which were not sustainable. How many of them were forced on organisations which were not interested, or felt that no-one was asking them what they actually wanted. Advertisement of failure is not a common practice.

<sup>28</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p20, (from Niccolo Machiavelli, The Prince, Chapter 6).





## 6. ORGANISATIONS

*'It is unrealistic to expect to make fundamental changes to the workings of an organisation in less than about ten years'.<sup>29</sup>*

The variation in traffic flows on roads can be quite astounding, when the road system is not classified on the basis on traffic, this can cause inconsistencies: *'Because the road system is relatively young, the classification is based on functional and administrative requirements and not traffic.....Highways have an AADT flow of between 10 to 2,700 vehicles and include earth, gravel and bitumen surfaced roads'.<sup>30</sup>*

There is a strong emphasis on institutional issues, and therefore on the organisations themselves. The technical aspects of maintenance are well documented and acknowledged, but the institutional issues are very variable and difficult to quantify.

*'Concentrating solely on operation improvements in the field as has been the case in the past can have, at best, only limited success'.<sup>31</sup>*

*'Effective and lasting change must be promoted from within the organisation itself'.<sup>32</sup>*

*'Change must be based on what exists and this means closely examining the current reality and placing the issues firmly on the table for an honest and impartial review'.<sup>33</sup>*

*'Objective indicators of institutional performance are notoriously difficult to define, measure and attribute, especially in the short-term period of five years'.<sup>34</sup>* If 5 years is short term, how can projects hope to achieve anything in two years? Perhaps a change in the lending policy is needed.

*'If funding levels were increased dramatically, the level of maintenance that could be carried out would still be limited because of inefficiencies in maintenance organisations. Most organisations have large labour forces which are unproductive because of poor management, lack of training, lack of incentives and lack of resources to carry out maintenance'.<sup>35</sup>*

Country U1

"The recurrent cost of routine maintenance is now mostly covered, whereas the Government still expects donors to fund periodic maintenance. The MMS has forced the budget to be programmed. The conditional grant stipulates how much to be spent on each activity. It was felt that the country had been broken up unnecessarily due to de-centralisation.

<sup>29</sup> ROBINSON, R., Road maintenance planning and management for developing countries. Overseas Unit, 1986, Highways and Transportation 33 (60 8-13, (7) 4-10, p4.

<sup>30</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p10.

<sup>31</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p18.

<sup>32</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p26.

<sup>33</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p28.

<sup>34</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p33.

<sup>35</sup> ROBINSON, R., A view of road maintenance economics, policy and management in developing countries, TRRL RR 145, 1988, p6.

**Country F1**

Classification system used in the country is based loosely on traffic, but the system has been around for a long time. The roads are classified as follows, and it is based on the function of the road:

Main – roads which provide links between cities and towns. The roads are mostly sealed, but some are still gravel.

Secondary – Feeds onto the main road. Approximately 50% gravel and 50% sealed.

Country – Rural roads which provide links to villages/ service farms etc. Mostly gravel roads.

Residential – Urban roads to cities etc.

Institutional – Roads servicing government buildings (schools, hospitals etc).

**Country N1**

The current aim is to increase monitoring and reporting of work produced by the divisions, to combat the apparent air of indifference to the quality of work produced by staff and contractors. Placing emphasis on 'ownership' of new systems and practices and not trying to 'force' people to adopt the systems, which may in fact be alien and inappropriate, is thought to be the key. Perhaps the auditing of programmes and plans etc., would force the operations to be carried out more efficiently, or perhaps the introduction of a very basic QA system? Implementing new ideas and the necessary motivation of staff within the organisations in the country is not easy, improvements to infrastructure are being tested, to see if an improvement in output results. The country apparently has to move away from the present autocratic structure. (It should place people in jobs which suit their ability and their interests) . Maintenance carried out in the country is mostly responsive, the project staff are keen for the divisions to institute their own changes, as the changes have a higher chance of being sustainable if they come from within the organisation. The division need to be committed to maintenance, their involvement does not end once the road has been built. The new Roads Signs Manual was accepted relatively easily in the country (apparently), so why was it accepted, whereas other systems do not succeed?

**Country F1**

The engineer pointed out that a report had been produced by a set of management consultants bought in to undertake an institutional review. The report they produced put forward that the current 'pyramid' management system should be removed and replaced by autonomous bodies such as: water, buildings, roads, mechanical, with the divisions being removed and the depots answering directly to an executive for the section at HQ. This would obviously result in some redundancies, but what the engineer felt was far more ludicrous was the fact that the depots have not currently got the capacity to take on the responsibility that would be required. No staff liaison regarding the new structure had been undertaken, even though it was due to commence in 1999. The new structure would require the employment of a graduate engineer for each depot. However there are simply not the numbers of graduates available and even if there were, he felt it would be a waste of talent to place them "out in the sticks". He felt the structure which saw Road Supervisors at the depots was far more appropriate and that the divisions fulfilled an important role. It is difficult to see how the structure suggested by the management consultants could ever work – perhaps it is yet another example of consultants making inappropriate suggestions. A considerable amount of money was obviously spent on the review undertaken by the consultants, but the outcome does not necessarily seem to be particularly appropriate.

**Country U1**

An interview with a respondent revealed: A workshop was held between the districts, attended by the District Engineer, Chief Administration Officer etc, to discuss maintenance and management. The workshop had had a number of plenary sessions and various questions had apparently been discussed and had resulted in a long list of resolutions, one of which was to take a 'bottom up' approach to maintenance where priorities are set at sub-county level. The sub-counties prioritise what they require with regard to road maintenance and this is put forward to the county and subsequently the district to be included in the programme. (Each district has approx. 6-8 counties and then each county has approx. 3-4 sub counties and then parishes). There can be much variation in the number of roads within each county with some having feeder roads and some not having any at all. Sub counties have a corporate identity and they retain 65% of the revenue they collect. The description of the workshop sounded very positive, and gave the impression that everyone had been able to give a view and participate thus creating ownership of ideas. [However an anonymous informant later pointed out that when he attended the workshop there had only been one hour allocated to the plenary session, the size of each group was around 50 people and there were too many questions to answer and consider in any detail. Thus the resolutions which were actually put forward were done so because a high ranking person stood up in front of the fifty or so people in each group and put forward their own ideas and as a result, everyone accepted them].

## Country B1

The zones and districts are not adequately defined. Some districts are split into constituencies for maintenance purposes, others are not. For example: one (A) district has 3 constituencies and another (B) has 16 constituencies. The routine maintenance part of the Capital II budget is therefore split 29 ways (constituencies) and that means (B) gets 16/29!

The chain of command is not really clearly defined to people at all levels. Extra linkages within the chain of command are needed. For example, the maintenance unit is not linked directly to the districts.

A respondent made the following general comments:

"Focus on results and measure success, thus giving accountability for the maintenance budget. Too much attention is given to the amount spent (or not spent) on maintenance, but less attention is given to what is actually achieved with the money. The measure of success should be what is actually achieved. Good management should involve establishing what can be done, and not allowing organisations to concentrate on what can't be done. The initial idea in one country was for work to be reported, it didn't matter if it was according to a plan or whether it was good or poor quality, the point was to report something tangible. Quality control, manuals etc. are only a small part of the equation. Establishing a delivery orientated environment is the key. The 'carrot' being offered is that if systematic maintenance can be demonstrated then rehabilitation could be offered at a later date".

"Money handling abilities are very low, engineering capacity is very low, and therefore encouraging the organisations to start small and try to establish the mentality of delivering against a budget is the most effective way of improving maintenance".

"Whenever new roads are required the districts tend to turn to the department of roads to build them. The problem is however partly due to politics, as the members have more control over central government than local government. By strengthening the districts the problem can be approached at the bottom end, the idea is not to instantly make them to rise to do everything that is put before them, the process is slow, but the gaps could be closed".

"Public accountability should focus on how many of the roads which are supposed to be maintained are actually being kept open, how many days the roads out of service when they are washed away, i.e. a measure of success. Public accountability is the best accountability. The idea is to allow the districts to look good, by getting them to demonstrate what they have actually delivered - by showing how many roads they have kept open, how quickly the roads have been re-opened, how many people have all weather access etc.: all indicators which allow an organisation to demonstrate what they have delivered with the money they have spent. Road funds, bonds and external financiers are all good ideas, but when the organisation is already struggling to spend the money they have, then more money is not the answer the problem, just spending what is already available in an effective way, must be the first step".

"Civil service reforms cannot be tackled in the short term, the key issue should be to address the building of capability to deliver against a very clearly defined output of targets - which should be kept simple. If commitment was present in the countries and people were really worried about delivering results, then worrying about the manuals would be worthwhile. When people are out on the road and you want them to do it better, then training, skills and manuals are important. When the people are not even out on the road, then other issues must be more important!".

## Country S2

"Money could be a motivator in the ministry, but the current civil service set-up uses salaries which are standard across the civil service. Different professions are equated one against another, which can cause problems".

"There is no computer literacy outside of head office, even in HQ the computer literacy is low. The visual base data and roughness data are important to the management of the network and the local staff should not try to carry out the surveys themselves, (due to worries about the data being made up, or just no carried out at all)".

"The Chiefs may make better managers than an ex-pat who can't even speak the language. For very little extra money, more effective maintenance could be achieved through the private sector"

## Country S1

In the country, there are 60,000km of rural roads and 40,000km of urban roads (all surfaced) and also 300,000km of gravel and earth roads.

"The agency agreement set up to administer the Main and Divisional Roads does not work, because the agency do not 'own' the roads anymore, but they have to carry out the work. The Province does not dictate what work has to be carried out, which can cause problems.

The district councils are often run by Civil Technicians who only have a diploma and do not operate in the same way an engineer would - no thought to economy".

*'Frequently in developing countries, the decision on whether to carry out a maintenance routine on a particular road is made locally by the man on the job (because the road 'looks bad', or due to complaints). Seldom is maintenance carried out as a result of any scientific or engineering measurement such as that recommended in OSRN 1'.<sup>36</sup>*

## Country L1

"The organisation has a well documented structure, with a government gazette listing all the job descriptions, salaries, number of positions, responsibilities etc. However, despite the fact that such things are documented, it would appear that the words are not necessarily put into practice".

<sup>36</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p31.

*'This single-track project approach, while generally adequate for projects with a clear physical objective such as the provision of a bridge, is not suitable for the more complex projects involving capacity building. These projects are concerned with changing institutions and hence, the thinking and perspectives of people. As there are many and varied routes to achieve this, it is important that the overall, long-term objective is clearly defined and accepted by the project stakeholders. This will, in turn, enable a thorough assessment to be made of the target groups, the true purpose of the project and the external factors which determine the success or failure of the project. By these means, the objectives can be realised using the best available routes selected opportunistically as project implementation proceeds'.<sup>37</sup>*

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<sup>37</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p17.

## 7. INEFFICIENT MAINTENANCE ORGANISATIONS

*'Significantly the maintenance of Feeder Road system...has changed managing authority six times in the last decade leading to the establishment of the Department of Feeder Roads under the Ministry of Roads and Highways in 1984.....'*<sup>38</sup>

Problems noted in Ghana: When no maintenance is required, for whatever reason, equipment and crew can stand idle. When no materials available, no work is carried out but crew still get paid. Drop in level of inspection due to breakdown of vehicles (no foreign exchange/ funds for spares and repair).<sup>39</sup>

### Country M1

The staff had been waiting since about March 98 to actually organise some maintenance. They had to undertake a full inventory of the earth roads within their jurisdiction, and then once the inventory had been established they would be able to undertake the condition assessment. However they had been unable to make any sort of start because they had no vehicles! They had one which needed repair and basically they would be unable to undertake any assessments in preparation for the minor contractors to commence routine maintenance until they obtained a vehicle, which is why they had done very little since March (4 months ago). When the inventory is established it will include all the usual information, but with regard to accessibility, emphasis will be placed on the bridges and culverts. The allocation of funds for the minor contractors comes direct from HQ and therefore the office does not handle the funds at all. This can cause a problem, when the local office are supervising the works and the HQ do not authorise payments to the contractors. Staff at senior supervisor level are required to move around at short notice and this is often detrimental to the work, as it means expertise in a particular region is lost. As well as the shortage of vehicles at the local level, (although perhaps not at the higher level) lack of money to buy spare parts and fuel is also a problem.

### 7.1. Employment issues

*'Large sums thrust on NGO's tempt them to induce participation (of the rural poor) and to achieve early results through subsidies. These then prevent learning from participants, because poor people will undertake work in which they are not interested if they are paid or fed for it'*<sup>40</sup>.

Ownership and the provision of work for poor people do not necessarily go hand in hand. Indeed it is not just the rural poor who need work. Staff of maintenance organisations will often have to supplement their low incomes with work outside the office, *'clandestinely and openly, staff undertake economic activities. Farming and other self-employment are common'*.<sup>41</sup>

### 7.2. Staff

*'The division chief is first and foremost, as manager. It must be accepted that working in a civil service environment, and in a culture which does not encourage the delegation of authority, places some constraints on his ability to manage'*.<sup>42</sup>

Lack of motivation of staff exists due to under employment, inadequate or regular fund allocations, poor facilities, staff remuneration and a lack of sense of purpose.<sup>43</sup>

<sup>38</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p32.

<sup>39</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p32, C3.

<sup>40</sup> CHAMBERS, Robert., Challenging the professions, Frontiers for rural development, 1993, Intermediate Technology, p85.

<sup>41</sup> CHAMBERS, Robert., Challenging the professions, Frontiers for rural development, 1993, Intermediate Technology, p111.

<sup>42</sup> HMG/N, Departmental Guidelines, Management manual for division chiefs, Sept 1995, p5.



The following table is adapted from (Heggie & Vickers 1998)<sup>44</sup>.

**Table 8 - Staff Salaries from a Selection of Countries**

Country	Road length km	No of staff	km/ staff member	Annual salary range \$(1996-97)
Ghana	15,232			
Engineers		125	122	1,500 - 2,000
Technicians		383	40	1,000 - 1,500
Pakistan	6,580			
Engineers		294	22	2,040 - 5,760
Technicians		1,251	5	840 - 2,040
		(Includes non tech admin staff)		
South Africa	6,133			
Engineers		63 (inc. 8 vacant positions)	97	32,000 - 46,400
Technicians		111 (inc. 21 vacant positions)	112	15,600 - 28,000

#### Country M1

"Treasury funding has declined for the last ten years. The expansion of the network and declining manpower resource has made the problem even worse. A registered engineer will only earn approx. £700 / month and the filling of posts with professional people is difficult, the number of deaths (many due to AIDS), obviously adds to the problem".

Construction of new roads gives pride to the engineers involved as construction is technically more demanding than maintenance.<sup>45</sup> The perception of staff as to their job and it's status seems to reinforce the fact that there is more glory to be gained in the building of roads and far more glamour than there is in maintenance.

#### Country B1

The respondent seemed to think that an excellent way for field supervisors to gain valuable experience was by being attached to large projects. He felt that at least one field supervisor in each district should be made into established staff. (at present the field supervisors are paid weekly and are not 'established'). He made a valid comment that by making at least one of the supervisors established, it would give incentives, mobility and motivation. Thus the supervisors would see a way forward for promotion, thus encouraging them to gain experience etc. With regard to operators and drivers of equipment, they are usually multi-disciplined to allow them to change between graders, dozers etc., thus allowing for staff holidays and sickness.

The respondent seemed to think that the contractors worked harder as they were paid for the work produced, he stated that they probably worked three times as hard for a task such as 'cutlassing'. The MoW staff simply have to complete the required tasks stated on the weekly crew card, so there is no incentive to work more quickly than the stated time. Too much reliance is placed on those staff who are working well, they become indispensable. Posts normally remain vacant, when a member of staff leaves for up to a year. Due to there being a lack of experienced people..... "Everyone who can do this type of work in the country is already employed!". Staff have to 'cover' for those staff who are overseas. Sometimes, 'handing-over' notes are used, so that the person filling in has an idea of what to do.

<sup>43</sup> HMG/N, Departmental Guidelines, Management manual for division chiefs, Sept 1995, p7.

<sup>44</sup> HEGGIE, I. G., & VICKERS, P., Commercial Management and Financing of Roads, World Bank Technical Paper No 409, 1998, p21.

## Country U1

"Testing of material to check quality is not undertaken at district level, it is the experience of the roads inspectors which is relied upon when choosing borrow pits. Road inspectors have a vast knowledge, however local government service has always been shunned by the bright and talented people because the conditions of employment are very basic. Therefore people with a lower level of education tend to be employed at this level. For this reason it was felt that the equipment which may result from the work of Element C is likely to be too sophisticated for use by the district level staff, despite the fact it could feasibly assist them".

## Country N1

There was apparently a problem of contractors often being quite inexperienced, they should be assisted where possible, thus enabling them to get started on contracts and gain valuable experience. Apparently, Civil Servants do not like to accept responsibility for new systems, as it may go against them in the future. Also the problem of a very quick change over of staff and the consequent loss in knowledge and ability. The staff in the division have to consider the possibility of being transferred to undesirable locations if they are not 'in favour', thus they are less tempted to keep an open mind to new systems and practices, as it may draw attention to themselves. The 'do nothing' option therefore appears to be favourable under the circumstances. In the hierarchy of the division, staff down to overseer level are permanent employees, whereas the supervisors and labourers are casual. This can cause problems with regard to obtaining experienced, well qualified supervisors. The supervisor is a key person, and a poor quality supervisor is likely to produce poor quality work. Political pressure can be exerted on the Divisional Engineer to employ particular people, and they will not always be suitable for the job they are intended for. The supervisors apparently receive some 'on the job' training, but as they appear to be the weak link, perhaps further training is required. There are many people in the country living well below the poverty line, is it therefore wrong to employ far more people on the payroll than are actually required?

Responsibilities/ job descriptions of the staff at DOR Divisions:

It is apparently normal for staff within the DOR to work without a job description or a list of responsibilities. The project staff working in the country have drafted job descriptions and responsibilities to try and regulate the situation within the Divisions. One Division Chief stated that a job description was used at engineer level, but not at overseer and supervisor level.

Lengthman system:

There appeared to be no evidence of lengthman being used on a number of the gravel roads, there were plenty of people around, who perhaps could have carried out the required activities, if money were available to fund the practice. The lengthmen employed as part of the funded scheme will not necessarily be employed by the division when the road reverts back to them, it would seem sensible to promote such a transfer of knowledge to ensure maintenance is continued, but it does depend on the available funds.

<sup>45</sup> HMG/N SDC/N, Strengthened maintenance divisions (Lalitpur, Bharatpur, Butwal, Pokhara, Lahan & Nepalgunj), Yearly plan of operation 1996/7, April 1996, p9.

## Country A1

“Just as unsealed roads are the last card in the pack in terms of attracting funds, they are also the last card in attracting technical attention such as high calibre personnel, proactive management, technical innovation and focused training for operatives. Notwithstanding this, it is not uncommon for grader drivers and the like to have an affinity with the road user community which motivates them to perform quality and efficient work. After all, unsealed roads are usually in rural areas where ‘everyone knows everyone’ and also the road users, and perhaps the operators are the rate payers”.

## Country S2

“Overseas staff being placed in ‘in-line’ positions, means they have more clout, but they get so involved in the day to day running of the organisation and the associated fire-fighting, that they are less able to get on with the job they are supposed to be doing. Very little measurable maintenance is achieved by staff - very low wages and dis-interest in working compound the problem. The numbers of staff should be cut, the pay should be increased and people should be made to work - are the organisations charitable institutions or are they there to do a job? Unemployment is in the order of 20%, one would therefore expect people to be keen to work and keen to keep the job. However, western world motivators are not present. There is a failure of private sector direct labour to deliver the required level of service and the general feeling is that privatisation is the only way forward”.

“The quality of the direct labour work is appalling and this is due, in part, to the lack of any sort of supervision and also a lack of knowledge at the supervisory level. The lack of knowledge is due to a lack of training. It is just about possible to communicate technically at the clerk of works level, but beyond that the staff have very little understanding of what work is required and usually no spoken or written English”.

“The feeling at a senior level in the ministry is that “we can't do anything”, therefore the climate for privatisation exists. However there is also the dilemma of what to do with the current staff (500 people)”.

## Country U1

An interview revealed: The district is currently understaffed as there are only 4 Overseers and no supervisor. The Overseers are supposed to look after 50km of road and the Supervisors 100km of road. They confirm measurements and visit the contractors every few days. The Overseers rely on motorcycles for transport, however two of them have to share as there are only 3 motorcycles. The length of road covered is 540.1km and consists of entirely gravel roads, which are major trunk roads, secondary and tertiary. There has been a recruitment ban, which has resulted in insufficient staff. The employment embargo was apparently brought in due to problems with corruption such as the ‘dead men on the payroll’ system which means peoples names appear on the payroll, yet they do not really work for the MoWTC and therefore someone benefits from their wages. There is a training school for overseers in the capital. The station has approximately 40 staff including mechanics, office staff, watchmen and drivers. Staff salaries come straight from HQ and the district therefore has little control. Sometimes payments do not come on time and allowances are apparently paid to keep people going. Money can be borrowed from the office management budget (for example). So some money is deposited on an account to allow the district to operate, but most payments are made by HQ who handle the money.

## Country S1

"There are a shortage of black engineers, the issue of a white engineer and a black labour force can cause tension within the community. The labour force of the council > 1000 staff. But currently, the workforce is perhaps 95% white, therefore a much larger number of black engineers are required".

"Productivity of staff can be a problem, as non-productivity is not an issue which a member of staff can be sacked for. Such a system does not encourage hard work. The unions are also split into mainly white/ black staff. The council would like to move to using more contractors, but the unions oppose privatisation as it would mean redundancy".

## Country Z2

"A major problem is turnover of staff - in the last year the respondent has been Deputy Engineer to 3 different Chief Engineers and now, now he is the Chief Engineer at the MoW. The engineers tend to leave because they can earn more money as consultants, or contractors, or even by working in neighbouring countries where skilled engineers are in demand".

## Country Z2

"Historically, the country had a good reputation for road maintenance and construction. Technically they are still good, but due to lack of funding they are no longer ahead. Pressure to privatise is currently being exerted by the donor organisations and is reluctantly supported by government. Unfortunately, such factors require shedding of staff on mass, to reduce the size of the civil service. People are being encouraged to take 'packages' to leave but it is not being carried out in a structured way. Quite senior people are being lost. Reform is fine but it must be undertaken in a structured manner".

"Many staff have been lost in the Ministry due to diseases such as aids: engineers, technicians and drivers, therefore people at all levels are lost for reasons other than financial gains to be made in alternative employment".

"It is a time of big change in many of the African countries, due to the setting up of Roads Boards, the idea being to have dedicated funds for maintenance. Different countries are at different stages but they are all going down the same route. At the same time the International Monetary Fund (IMF) are imposing limits on government expenditure. At a government level they want to reduce public spending so that existing funding can be channelled into the private sector. The impact is that the number of civil servants have to be reduced. The staff which leave with a redundancy package do not necessarily stay within the engineering field, they set up stores, buy taxis etc. and therefore the experience is being lost due to the unstructured trimming of staff levels in the civil service. There is a big push to improve the roads in the township areas, which are still predominantly gravel and earth roads. There are opportunities for black engineers to move to neighbouring countries and earn higher salaries. The civil service pay is poor".

## Country U1

"Productivity is based around the maintenance guidelines and the cost of labour within the central region is recognised as being higher than in the other regions, therefore the rates reflect this. MOWTC is forced to review the rates when the local labour force demand more money".

## Country T1

"The work for engineers is scarce in Tanzania, and there are many unemployed engineers, especially graduates. Basically, government is not employing any new staff, due to the current economic climate - there is insufficient work. Since 1994 the local level staff (employed as part of direct labour gangs) have been made redundant. The transition to agency status was currently being undertaken and therefore the direction was sometimes unclear and decision making often took longer than necessary".

## Country L1

"The real problem (which has a tenuous link to manuals) is the fact that the staff won't ask questions if they are stuck. They would rather fudge the work, cover up mistakes and make a mess, rather than admit that they do not know what they are doing". The statement didn't just relate to the lower level staff, so again, it is perhaps a cultural thing? Perhaps because the environment is different to the type of environment where the asking of questions is actively encouraged as a part of the learning process? It is easier to make a mess of the job, knowing that there will be no retribution, rather than ask a question?

"Staff motivation is another problem area, this may be due (in part) to the very low wages. A labourer would probably earn the equivalent of £2.50 per day and a graduate engineer £6,000 per year, with a Chief Engineer earning £10,000 per year".

### 7.3. Training

*'There is normally a particular need for the training of road maintenance staff. Often skills have been learned on-the-job, and staff have a very practical approach. There is often a lack of exposure to theoretical concepts, with the result that a very conservative attitude prevails with respect to change'..... 'Experience has shown that an institutional appraisal, covering external, institutional and technical issues, is the most effective method of identifying clearly training objectives together with institutional constraints'*<sup>46</sup>

## Country B1

A training officer has been appointed, but the respondent commented: "he doesn't do much". The MMS office do carry out some of their own training, connected with the system. Training is sometimes undertaken if a member of staff is involved with a project funded by overseas aid. The laboratory technicians have undertaken courses overseas and scholarships are also available. Most staff are self-trained on computers. A VSO was employed for two years to teach Autocad. Some of the DTS's do actively motivate their staff, but generally people do not capitalise on their potential. Job descriptions are apparently used only for the permanent staff. (Later discussions with a source revealed that job descriptions and responsibilities are rare).

<sup>46</sup> ROBINSON Richard, DANIELSON, Uno and SNAITH Martin., Road Maintenance Management, Concepts and Systems, Macmillan 1998, p60.

*'Where personnel have inadequate skills or lack motivation the effectiveness and efficiency of operations are severely constrained. Training has often been seen as a panacea for solving problems in this area, but the record of training in many situations has been disappointing. One reason for this is that, too often, training has been seen in isolation from the broader subject of human resource development'..... 'There are a variety factors which may cause ineffective use of manpower, including poor personnel policies resulting from the application of inappropriate rules of service, conditions of employment and pay, and lack of accountability and incentives, the level of an organisation's efficiency and its structural complexity'..... 'Adequate staff remuneration is a key component of an effective road administration.'..... 'Training is not optional: it is essential to both organisational and staff development. Without training, stagnation results'.<sup>47</sup>*

#### 7.4. Manuals

*'Frequently in developing countries, the decision on whether to carry out a maintenance routine on a particular road is made locally by the man on the job (because the road 'looks bad', or due to complaints). Seldom is maintenance carried out as a result of any scientific or engineering measurement such as that recommended in OSRN 1'.<sup>48</sup>*

In a country where there is insufficient money to maintain the national trunk road network, there is unlikely to be enough money to maintain the district road network, and as for the low cost rural roads, they are unlikely to figure at all in the equation. So how can a manual make a difference? Well it probably can't. In an ideal world, or even an efficient organisation where money was not an issue and organisations were efficient, a manual may help. But it is unlikely to make any impact at all when it talks of keeping to standards which are wholly inappropriate. The local road foremen knows what he can do with his scant resources, and he doesn't need a manual to tell him. There is perhaps a temptation with research to produce a manual or guidelines, because they give a tangible and visible result, an output which people can put on their shelf and use. But if they don't use the manuals, then what is the point. A change in perceptions is perhaps a more worthy output, if it allows further work to be carried out that will actually make a difference. Manuals are useful, but they are not a panacea.

Manuals which are developed in-house are far more likely to be used than those which come from overseas and are not designed for the organisation itself. Ownership can be created by writing in the local language, by using diagrams and pictures relevant to the country and by establishing what exactly the users want. *'.....feedback has shown that greater consideration needs to be given to the improve readability and understanding in the local context. In particular, more use should be made of the Nepali language. This point has been taken into account in the preparation of the Road Maintenance Manual which is being written directly under the guidance of a DOR editorial committee'.<sup>49</sup>*

Manuals are therefore one of the issues, guidelines on specific issues are useful in particular situations, but only if the right people have access to the right manuals and guidelines.

#### Country U1

*"Previous projects in the country have produced manuals, sometimes in the local language. The manuals need to be accompanied by training. The Roads Inspectors know what they are doing once they have been trained. They don't necessarily even need a manual".*

<sup>47</sup> ROBINSON Richard, DANIELSON, Uno and SNAITH Martin., Road Maintenance Management, Concepts and Systems, Macmillan 1998, p59.

<sup>48</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, A thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p31.

<sup>49</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p40.

## Country U1

An interview with a respondent revealed: The district engineer had a copy of the PIARC books 1 and 4, but not the others. They were kept in his room and were the station copies. Whether or not the overseers got to look at them was debatable, but he felt they were useful books and he also used the Maintenance Management Guidelines (a copy of which had already been obtained from ASIST). It was good to see he actually used it. There were no computers and the offices were very sparse, electricity is probably not wholly reliable in the district. The engineer seemed to have very little control over what he did, with HQ a significant distance away dictating what work could and could not be undertaken.

A respondent commented:

"As for manuals, all I can add is that I have found that the most avid readers of the better manuals aimed at junior technicians and supervisors are in fact senior engineers who lack the confidence in planning practical work but who are not prepared to ask questions which may expose their ignorance".

*'Information is power in an organisation, and access to information may influence who has the formal authority or informal power to make decisions'.<sup>50</sup>*

## Country B1

Overseas Road Notes and International Road Maintenance Handbooks appear to be available. Apparently, a number of manuals were handed out to the MoW offices as part of the project.

When asked about access to manuals such as the PIARC handbooks and the OSRN's, The respondent confirmed that he had copies of all the documents, although not enough for his staff to have their own copies. He pointed out, that although the information was useful and they were useful 'reference guides' for techniques, the main problem with them was that they only allowed for optimum conditions. They were not APPROPRIATE for the conditions which prevailed in the country. Optimum staff levels and a quantity of tools are simply not a reality.

The organisation has not produced its own maintenance manual. The Deputy Chief is interested in the idea, but simply does not have the time. The production of a new manual

would therefore have to be undertaken by a private consultant. More copies of PIARC/ OSRN are needed, if they are to reach people such as Supervisors. But it is questionable whether or not they would actually be used by the people they are intended to help. The international documents would be better if they were amended to be country specific. The new MMS uses worksheets based on the PIARC handbooks, but only because the consultant decided to adopt them.

## Country N1

Overseas Road Notes and the PIARC International Road Maintenance Handbooks appear to be available, but perhaps not in the required quantity. There are likely to be insufficient copies in the districts and the offices which have not so far benefited from the project aimed at strengthening the working environment. The engineers normally keep a copy, but the supervisors, do not appear to have access.

Country L1

“With 90% literacy the reading of the manuals was not a problem. The staff do have access to copies of the PIARC Handbooks, but the Supervisors and Overseers would be very unlikely to use such manuals, because they know what they are doing. It was not a case of the manuals containing the wrong type of information, whether they did or not was of little consequence”. On being asked what would happen if a new manual with all the answers appeared in the MoW, the respondent stated that it would be put on the shelf with the rest.

Country M1

There are apparently 2 training schools in the country and there is normally training given for supervisor and foreman level, but not below. Manuals are used, but no copies were available at the office and it was reported that it is normally only the training centres which have copies.

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<sup>50</sup> SMITH, Roger. E., & HALL, James. P., Overview of Institutional Issues in Pavement Management Implementation and Use, Conference proceedings, Third International conference on managing pavements, 1994, p54.





## 8. MAINTENANCE

*'...on low-volume roads, maintained by labour based methods, it is unlikely that there is any economic justification for insisting on the close tolerances of level and smoothness which can be achieved by the use of equipment'.....'Paved and unpaved road maintenance are quite separate activities and not only require different levels of expertise, but also different plant and materials. Variations in the quality of maintenance can often be directly attributed to this approach. It is suggested that specialist teams, expert in a particular aspect of maintenance, will always achieve a higher degree of remedial treatment than teams of roadman expected to cope with a wide variety of maintenance problems'.<sup>51</sup>*

(Routine maintenance) 'The advantage of the lengthman is that the task to accomplish is easy to define, the performance of any individual simple to assess and the transportation of labourers is not required'.<sup>52</sup>

### Country N1

"The awareness that preventive minor maintenance would drastically reduce the cost of later, major maintenance was hardly existing. A bridge caretaker system to execute preventive and minor maintenance worked quite well as long as all involved actors fulfilled their obligations and the caretakers received their payments as per their contracts. However, as soon as some corrupt government officers misused the allocated funds the system collapsed. Another system where a contractor was licensed (through bidding) to collect a bridge toll did not function because neither the contractor nor the local government used the accumulated funds for bridge maintenance".

The definition of the different types of maintenance are given as follows<sup>53</sup>:

**Table 9 - Definitions of Maintenance Terms**

Category	Definition
Routine	Set standard work activities regularly and frequently carried out through out any given year, to retard the onset of deterioration's, to upkeep as built constructions and to generally maintain assets in an acceptable serviceable state. Activities being patching, drainage grading, resheeting, sides and bridges.
Periodic	Major specialist pre-programmed and improvement works carried out once every few years to the road infrastructure. Examples being pavement overlays to rehabilitate strengths and extend fatigue design life lengths, resurfacing to chip and asphalt bituminous sealings, unsealed roads major regravelling, bridges painting and structural refurbishments, roads geometric and traffic safety improvements.
Rehabilitation	Restoration works required to repair major damages caused by forces of nature extremes resultant from events such as major cyclones, floods, earthquakes and tidal waves. Frequency not readily able to be predicted. Programming and funding provisions on a contingency basis.

<sup>51</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p41.

<sup>52</sup> Strengthened maintenance divisions, Phase 1, July 1994 to June 1998, Project Document, Aug. 1994, p8.

<sup>53</sup> Fiji Government Ministry of Infrastructure and Public Utilities – Annual Road Maintenance Report 1995. Prepared by the Road Maintenance Strengthening Unit, Public Works Department, p8.

## Country F1

Vehicles registered in the country from 1965 – 1995 (including all types of cars, goods vehicles, tractors and motorcycles) has risen from 13641 to 98655. The level of service guidelines give the following guidelines for the maintenance of unsealed main and secondary roads:

- a) Grading to be carried out about 3 times/year*
- b) Inspections to be carried out every 2 months and repairs carried out. Repairs to include spot gravelling to fill potholes.*
- c) Drainage to be carried out once/year (before wet season). All culverts and drains to be inspected and cleaned. (Note that drains can be cleaned and shaped during pavement grading).*
- d) Weeding to be carried out twice per year in towns and villages. Once per year elsewhere.*
- e) Signs and road furniture to be inspected once/ year. Repairs to be carried out by carpenter.*
- f) Bridge maintenance (as for major roads sealed).*
- g) Village seals to be maintained to the same standard as for subdivision roads.*

*For country roads:*

- a) Inspect pavement twice/ year and carry out repairs (pothole repair and repairing cracks).*
- b) Inspect shoulders and drains once/ year. (Blocked drains to be cleaned prior to wet season).*
- c) Weeding to be carried out once/ year after wet season.*
- d) Signs to be inspected once a year.*
- e) Bridges to be inspected at least annually and after flooding.*

*For other roads:*

- a) Inspect pavement once/ year and carry out spot gravelling and/ or patching to fill potholes.*
- b) Grade once/ year.*
- c) Drainage to be inspected once/ year and blocked drains cleaned prior to wet season.*
- d) Weeding to be carried out once a year.*
- e) Signs to be inspected once/ year and repairs arranged with carpenter.*
- f) Bridges – as per major roads sealed.*
- g) Village seals – as per subdivision roads<sup>54</sup>.*

<sup>54</sup> Government Ministry of Infrastructure and Public Utilities – Annual Road Maintenance Report 1995. Prepared by the Road Maintenance Strengthening Unit, Public Works Department, 10.5 p5.

## Country U1

"A problem with Feeder Roads is that there is no satisfactory criteria, no definition of what a feeder road actually is. The standard for Feeder Roads was established in the 1960s, and the whole system of classification is now very outdated.

Class 1 – 6.5 to 7m width

Class 2 – 4.5 m width

Class 3 – 3m width

Class 4 – Community Road

Trunk or main roads connect the districts and the Feeder Roads connect the districts to the villages. The roads within the villages are the community roads.

The post war construction period ended leaving time for reflection and a time to change things. The employment embargo has not really affected the districts too much. Yet the real problem was the fact they could not afford to employ enough staff. Each district normally has a DE or supervisor (if qualified to technician level only), an assistant and 2 roads inspectors. Many of the District Engineers cover buildings, water etc and they therefore have a roads supervisor. Some districts are still undertaking fire fighting activities with regard to maintenance, especially as their networks are very large considering the number of staff available to look after them"

## Country U1

"Contractors and labour can be found easily enough, but in certain sparsely populated areas there is more of a problem and the labour has to be transported in which increases the costs. The force account work tends to be undertaken within travelling distance of the office, as there is not sufficient money to pay staff allowances to work away. Force account labour gangs were on the payroll, yet they were often idle".

"Problems with maintenance relate to prioritisation at all levels and programming. The rehabilitated roads should be maintained, yet, when a road is taken over by a station it is sometimes neglected. This is probably a management problem, as there are many districts but the funding is centralised, more control is needed at the station level. The District Engineer should be made to be accountable. The implementation should be at station level. (It used to be like that and it should be again). The introduction of the Road Agency will ensure a road fund is used. The numbers of staff should not be a problem, but some specialised training will be needed. There are many qualified engineers but very few technicians and overseers. The management is in place but there appears to be a shortage of people to implement the work. The reduction of staff numbers over many years has caused the problem.

## Country U1

An interview with a respondent revealed: The district of Mukono has 810km of gravel and earth feeder roads and also over 1000km of community roads (maintained at a sub county level). The district has a District Engineer, a superintendent of works – roads and 6 inspectors (in the case of Mukono, one per county), with each inspector having a motorcycle. In Mukono there are 6 counties and 32 sub counties all of which are split into parishes. Some sub counties have over 100km of feeder road and some have no feeder roads at all, and as the sub counties actually fund the roads in their area, this can cause a significant problem.

The roads are graded, with a 2<sup>nd</sup> grade road being gravel and a 3<sup>rd</sup> grade road being earth. The more important roads are graded every 3 months, and some of the least important ones have not been graded for 10 years. Yet they have been effectively maintained by small labour based contractors and so it is not always easy to see a difference in the end product. The contractors are paid 2300 Ushillings per person per day for their labour force of 10 people, but they pay around 1000 Ushillings to the labour, and so they make a profit. The contractors work 22 days per month (usually May to Oct).

## Country U1

“It is normal to only receive about 50% of the money required to maintain the roads in the area. Prioritisation is based on traffic levels and importance of the road. An annual programme is produced and the progress plotted, and submitted as part of the monthly report to HQ. With regard to emergencies, there is no actual budget for it, so generally the equipment and labour will be moved to the site requiring emergency treatment and then a request will be made for the money. Sometimes the stations are required to work together to overcome emergencies”.

“An idea of the allocation for force account work is known in advance and the programme is formulated as a result and submitted to HQ. The programme is then prioritised to take account of the difference in the expected and received budget. When money is diverted for one reason or another, the contracts cannot be undertaken as programmed, therefore some of the work is undertaken by force account instead. The force account work tends to be mechanised. It is intended to keep 15% of the work as force account to cover for emergencies etc. As a result a certain amount of equipment will have to be maintained”.

## Country U1

“Many of the districts do not have electricity and they do not have computers. There is a real problem of the perception of people to the role of the roads supervisor, the role is often thought of in similar terms to a ‘handy man’. However, people are slowly beginning to understand the concept of effective management. It is the management of resources that is failing the districts. The five ‘M’s: Manpower, Methods, Money, Materials and Machinery. Generally the Chief Admin Officer (CAO) does not have any idea what is going on with the roads in his district. Therefore a road maintenance forum was established to meet every two months in each district to enable the treasurer and CAO to understand what is happening. Improvements have actually occurred over the last five years. The road agency may or may not include Feeder roads, it is not certain at this stage. Despite equipment shortages in districts they are fiercely proud of what they do own and as a result they will not share”.

**Country U1**

“Periodic maintenance tends to be funded through donors. Districts have little capacity for periodic maintenance unless it is funded from outside. In any cases there was only sufficient money to carry out partial routine maintenance. Basically, if the maintenance management system stated that 20 days were required to fill in pot holes for a particular road and the budget allocation only allowed 15, then the engineer would know that the work would not be completed. They obviously wouldn't tell the contractor that they wouldn't be able to finish. What they did was to tell them to start with the worst pot holes first and then move on after 15 days, therefore the worst pot holes would be done and some would not be done. The recurrent cost of routine maintenance is now mostly covered, whereas the Government still expects donors to fund periodic maintenance. The MMS has forced the budget to be programmed. The conditional grant stipulates how much to be spent on each activity”.

**Country B3**

“The awareness that preventive minor maintenance would drastically reduce the cost of later, major maintenance was hardly existing. The government allocated more than sufficient funds for bridge maintenance. The society was in a transition from the old (feudalistic) system, where a powerful official organised and ordered the maintenance of public infrastructures, to a new, more "democratic" system. Technicians and bureaucrats were used to think in "project frames", where a clearly defined set-up was needed. Flexible, small and low-cost options for regular, preventive maintenance did not fit into this project frame”.

**Country U1**

“The goal of the ‘project’ is to achieve better maintenance through the provision of ideas, equipment, training and the introduction of an MMS. 27 districts (+4 under) which had already received some rehabilitation work were chosen to participate, thus the North of the country has really missed out, (as there was no donor funding in that region). The Central and Western regions of the country have benefited far more. The project appears to have been successful so far. An injection of money for periodic maintenance has also been provided by the MoWTC”.

“There has been some disappointment as the districts have not improved as much as was originally hoped. The district revenue was supposed to match the contribution made by the MoWTC, but it has not. Other factors such as health care seem to take the lions share of the revenue. The revenue should top up the conditional grant (which is used solely for labour based works), but the law is the problem. The revenue is collected at sub-county level, yet the sub-county keeps 65% and the centre of district receives 35%. Some districts are doing better than others, it depends a lot on the affluence of the area. Generally the districts use force account, but in the districts which come under the project, the ‘gang men’ have become small scale contractors, and employ 10 men. The project has allowed them to build their capacity through training and the provision of tools. There are various conditions attached to the conditional grant, and the ‘project’ has been a good vehicle for enforcing the conditions. The conditional grant started in 1996/7. Yet, it is not sufficient to cover all the required maintenance”.

“Apparently much supervision is needed as the districts often try ingenious ways to divert money. Some districts think maintenance is about providing the equipment with fuel so that the Chairman’s road can be graded. Some districts are actually unable to spend the money they are given. There is much bureaucracy, the districts do not operate as a team and the District Engineer is often ignored. There is much political influence at that level and the councillors insist certain work is important. However, because some work has been carried out since the war this has helped to prevent the ‘fire fighting’ approach from continuing longer than necessary”.

## Country A1

"There are over 500,000 km of unsealed roads, (262,000 with gravel surface, 201,000 formed only and 37,000 cleared only".

"Until about 15 - 20 years ago, there were still strong annual programs of converting unsealed to sealed. These have significantly reduced, due to the recognition that as a result of past construction programs, funds need to be allocated to maintenance of existing sealed roads before additional lengths are sealed".

"While it is not necessarily cheaper to maintain an unsealed road, the perceived and real loss is usually less when maintenance of an unsealed road is neglected, as compared to neglect of a sealed road. There have been highly publicised but relatively isolated instances of sealed roads reverting to unsealed due to a lack of maintenance funding".

"I think it is fair to say that it is only recently that people have ceased to expect that one day all unsealed roads will be sealed, or at least that a good many more unsealed roads will be sealed. Dearer assets attract higher priority for maintenance. I guess that typically unsealed roads have an AADT of less than 300 vehicles per day, but many are less than 100".

"I recall unsealed Main Roads (i.e. managed and funded by the State) with AADT around 100. These were mostly gravelled, graded about once per year, and resheeted on perhaps a 10 year cycle. Formed only roads were graded after wet weather - in wet weather they bogged up, and were extremely rough afterwards. Of course also, there was much benefit in grading while moisture content was high. Nearly all work on unsealed roads is classed as maintenance. Maintenance management has not been a strong point for the country's road industry".

"On speaking to an engineer, I found he has approximately 600km of unsealed roads, with AADT ranging from 20 to 100 vpd. His Council has "classified" the unsealed roads into Classes 1, 2 and 3, depending on their importance based on a number of criteria including traffic volume and type, and especially whether they are bus routes (school buses). Resheeting cycles are approximately 5 years, 10 years and 15 years for Classes 1, 2 and 3 respectively. (This appears to be a surrogate for different condition standards for roads with different economic and social purposes.) The prevailing wisdom in his Council is that it is unrealistic to expect any ongoing reduction in the length of unsealed roads or extension in the length of sealed roads, except for special cases such as when new mines or other industry establishes. Dust is an issue they just live with - they do not study dust patterns - they feel powerless to reduce dust. They use local natural gravels of varying quality but still with large quantities available. (Not all LGAs are so lucky - diminishing sources of natural gravels are a real issue in many places. The diminution arises either from depletion of known sources, or from environmental constraints on opening new deposits or extending existing workings. They have changed their grading practice in recent years by enlarging the operation to include watering and rolling as well as grading. They consider that the increased cost of each operation is justified by the increased durability of the resulting pavement (i.e. longer periods between regrading operations). A technical innovation in recent times has been to equip grader blades with specially designed tynes which improve the mixing action and better incorporate fines back into the upper pavement layer".



## Country U1

An interview with a respondent revealed: The force account work is programmed, but it appears that they do not stick to the programme. The district submit their requirements to HQ but the amount of money allocated depends on what the MoF allocates rather than what they need. The programme for 97/98 showed priorities for various roads and apparently none of the contract work which was priority 1 had been undertaken, it was instead done under the force account system and as a result, the work which should have been carried out as force account was not completed (it was a lower priority).

## Country B1

New contracts in the MoW have to demonstrate to the funder that they have a 5 year, or even a 10 year maintenance plan. Thus the MMS will allow them to demonstrate that fact more easily. As for the actual maintenance of the road, the concept of a 'maintenance free' road was being adopted for the upgrading of the highway.

The dust on the highway is a major problem, the crops along the edge of the road, despite the fact they are set back some distance, were covered in dust. (The dust actually kills the leaves of the plants). The safety problem which the dust produces is yet another issue, when vehicles pass, or one travels behind another vehicle, it is almost like travelling through dense fog! It is interesting to note that most towns do not have paved roads, this creates a very unhealthy environment for those people living there, as there is a considerable amount of dust in the air.

The 'X' people apparently all work for the good of the community and they kept the roads in quite a good condition, with the verges neat. A small boy was cutting one verge with a 'sit on' mower and a lady was doing the same further down the road. The community have a lot of equipment for their farms etc., so they just use it for their roads too. They have apparently even set up as a contractor and carry out highway works for the Ministry!

A clear definition of road maintenance is not really available to people at all levels, because the old system which may have defined road maintenance, has not been up-dated with respect to such definitions. Road maintenance planning procedure is not reviewed as regularly as it should be. Very few communication links exist between those staff responsible for: design, construction, surveys, and road safety. Maintenance techniques selected by give few alternatives and tradition plays a large role.

## Country S1

"The townships have now been absorbed, although there are still some divides. The townships still have a much lower standard of road, due to the fact that they were traditionally of a '3rd world standard' prior to the changes in the country. In contrast the other areas have a much higher standard. The current problem is therefore to bring the township areas up to a higher standard. The townships have predominantly unpaved roads and they have greater community participation".

## Country N1

Stage construction of roads is often adopted, where a road starts as an earth road (without compaction) and is then upgraded as the road becomes more important. The project staff have put together guidance notes. There appears to be little regulation or monitoring of maintenance, and little money to carry out the work, apart from on the strategic network. Tolls can work, and the project staff are trying to promote the idea of the toll money going directly towards maintenance. However, they have reported that such a system is only economically viable on roads with an AADT in excess of 950 (Area A) and 1350 (Area B), therefore it is unlikely to be a practical solution for low cost roads due to the normally low volumes of traffic.

Counting the number of potholes in a road gives a snapshot in time and is not a satisfactory way to plan for maintenance. Stone soling seemed to be used successfully to combat soft spots, but the cobbles often became disturbed and as a result did not lie flat, making 'dragging' rather difficult. Regravelling may be the only answer to combat the rough surface. Local people can produce hand knapped aggregate quite effectively, but only in modest quantities. The maintenance crews working for the funded project, work on maintenance for the whole of each year, whereas the direct labour crews are apparently called away frequently to work on non-maintenance tasks such as the district road program. Gravel roads which are part of the strategic network have a yearly maintenance allocation, but the lower class gravel roads do not. Inventories of the strategic network have been initialised by the project, but the remaining roads are treated on an ad hoc basis. There does not appear to be a prioritisation system for the maintenance of gravel roads which are not part of the strategic network, although the project appears to be addressing the issues. Maintenance money is requested by the Division Chiefs from the Government. One chief admitted asking for more money than was actually needed, as he knew he would be given less than he requested. All the people spoken to as part of the investigation were well aware of the need of maintenance, but they were resigned to the fact that money was simply not available, as more emphasis was placed on new road construction by the politicians. Difficulties with getting landowners to agree with material from their land being used for highway works was noted, but it was pointed out that there may be a compensation system. The project promotes the concept of only maintaining those roads which are in a fair to good condition, as these will benefit from the maintenance. Whereas a road in poor condition will not benefit as much from maintenance, as it actually needs rehabilitation or reconstruction. There should be minimum standards for the construction of roads, to ensure that when stage construction takes place, the earth road is of a suitable construction to be gravelled.

Safety issues: Rehabilitation of roads in poor condition can result in increases in accidents, as the vehicles travel faster, a rough surface can act as a form of traffic calming, but this would need to be proved. Road safety education has been more successful in the east than the west, perhaps due to the larger numbers of tribal people in the west. The tribal people who only occasionally visit the larger villages and towns are not familiar with fast moving vehicles.

"The size of the area to be managed has increased but the funding doesn't seem to have increased. In the townships, the people pay for perhaps only 20-40% of the services they are receiving".

"Drainage is the biggest problem currently facing the council. Flooding occurs because the houses in the BT are very often built below the level of the unpaved roads and they have also been built too close to the roads. Tracks which lead to 'squatter settlements' have now been classed as low quality roads. The basic services have to be provided to such areas, which has increased the maintenance bill".



## 9. CULTURE

*'Cultural constraints can usually be overcome only when people reach their own conclusions that it is in their best interests to change'.<sup>55</sup>*

*'.....the precepts of the single party system, where patronage determines the main route to personal advancement, are ingrained in society and are proving slow to remove. The change to a more meritocratic based society is therefore difficult. As a consequence, government is characterised by strong political involvement at all levels of the administration and a relatively weak bureaucracy'.<sup>56</sup>*

*'....autocracy and patronage are still ingrained into the society and continue to be the guiding principles for development'..... How do you change something so fundamental? You don't try to, you instead work with it. '.....for instance in the sphere of human resource development and the better use of the human resource (the principle resource in Nepal), require a radical change in society itself. There is ample evidence that this change is taking place but it is a necessarily slow and unpredictable process. Clearly, the environment is not conducive to change but neither is it preventative'. Slow change must be accepted. ....'The danger is that we continue to tinker at the edges while largely ignoring the constraints and their effects'..... 'Nepal is at an early stage of the Development Curve and all institutions, both in government and the private sector, are generally characterised by uncertain policies, weak management and low capacity'.<sup>57</sup>*

<sup>55</sup> IT TRANSPORT LTD., Promoting Intermediate Means of Transport, Approach Paper, Oct. 1996, SSATP Working Paper No 20, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p29.

<sup>56</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p7.

<sup>57</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p43.



## 10. CONTRACTORS

*'...local contractors tend to be more efficient in operations which are less complex'.<sup>58</sup>*

By encouraging organisations to undertake work using contractors, is there perhaps an assumption that the contractors already exist and are ready and waiting to carry out the work.

### Country B1

Little use made of contractors with respect to the Recurrent budget, but up to 50% of the periodic Capital II budget uses contractors. Machines are hired, and an increasing use is now being made of local contractors. There are some contractors, but more would be better to make the whole process more competitive. There is one large contractor and others come from surrounding countries/ overseas. If the work of the contractor is unsatisfactory, "They get away with it!", i.e. no protection for the client.

### Country S2

"With regard to gravel roads, there are roughly ten competent contractors, the work over the years has not been very good, and therefore they are currently trying to tighten up on the quality control. Adequate supervision is difficult to achieve. A local consultant was involved in the issue of supervision, but even that method didn't always work - the local consultants are often more on the side of the local contractors".

### Country U1

"A real problem has been the fact that the contractors have been trained and then they are removed by local councillors who replace them with their own people, so much political influence is unfortunately a reality. The project provides the district with hand tools which they then sell to the contractor, who in turn includes the cost of the tools in the rate. The district can then replenish their stocks. The contractor can pay labourers, and headman and buy tools and still make a profit. The daily labour rate is 2300 Ushillings and daily targets are set which are based on an 8 hour day, however some districts seem to operate 5 hour days and the contractor still claims 8 hours! The labourers usually have small farms etc and so they tend to work from 7-12 in the morning and then go home to rest before tending their farms".

<sup>58</sup> FEKPE, E. S. K., Paper - Highways and Transportation July 1991 p31-36. Road maintenance strategies in Ghana, p36, C1.

## Country U1

"The field offices have maintenance engineers who undertake spot checks on the contractors, checking number of labourers on site and the activities being undertaken. It is quite common for the contractor to have less people on site than the specified 10, and there are many excuses given for where the people are, such as: "they are fetching water", "they are sick" etc. The contractor therefore makes even more money as a result of paying less than the 10 men he is claiming for. Prior to the project the politicians and the contractors believed that routine maintenance meant cutting grass only, and therefore that is what was carried out. The Maintenance Management System has forced appropriate routine maintenance to be carried out. There was resistance from corrupt engineers and from contractors. The contractors now know what is expected. There is very little direct labour now, mostly contractors are used. Petty contractors carry out routine maintenance and small - medium contractors carry out periodic. Often International contractors would tender for the maintenance and would be 30-40 times over the engineers estimate, the reason being that there were not enough contractors able to undertake the work. Now however, through training, there are more able contractors. Small contractors were trained and grouped together to win work, plant was hired and they are now starting to obtain their own equipment. They were also given help with the rates".

## Country U1

The DE pointed out that the contractors are only managing to complete about 40% of the programmed work owing to shortages of equipment. The term maintenance contract has been limited to 1.2 billion Ushillings. Each certificate cannot go beyond 120 million, therefore if the contractor happens to complete more work than expected he can only be paid for 120 millions worth. The DE stated that the limit on each certificate should reflect the seasons and should vary accordingly. Thus when it is possible for the contractor to complete a lot of work, or when it is not possible for him to complete a lot of work due to whether, the certificates should reflect that. The force account labour has had to come in and help out when the contractor has been unable to complete his work, to ensure the programme is kept to. The programme is agreed for each road, however while the contractor is undertaking work on one of the roads, the other roads may be deteriorating and thus the force account labour is used to maintain the road in the interim, until the term maintenance contractor arrives. The term maintenance contract was awarded late and as a result the district had already budgeted for the roads to be maintained by force account. The contractors employ locally available labour, and they do not transport in labour unless particular skills are required or there is a shortage of labour in a particular area. The main problem with maintenance is the lack of transport which results in a lack of supervision of the contractors. If an overseer has 100km of road to supervise he needs a motorcycle and the motorcycle needs maintenance. The workshops therefore need to be well stocked as it is not convenient to send the vehicles to the central equipment division for repair.

## Country U1

An interview with a respondent revealed: It is the intention to reduce force account to 15% of the work to cover emergencies and efficiency should improve as a result. The emergency work will require the stations to hold on to some equipment. The contractors should be able to hire equipment from the stations and repair it, with the hire charge being deducted from the certificate, thus allowing the contractors capacity to be developed.

## Country U1

"The minor contractors are given between 1km and 10km, or sometimes longer lengths if they are able to transport the labourers. People are now very interested in maintenance. The contractor must have tools and a labour force to be employed by the MoWTC and they must be known to the village administration. They also have to be a member of the village they are intending to work in. Forms are filled in and approved. There are sufficient good contractors in the area. The problem is the lack of supervision, which is due to the lack of staff and transport. Labour is far easier to find in rural areas, and is also cheaper".

## Country S1

"Maintenance carried out in the townships uses labour intensive methods and money is allocated for training as there is a high level of unemployment. Liaison officers are used to try and work with the local people. People are encouraged to work, especially as contractors. A contractor will bring in a skeleton staff to the area and then employ local labour".

"There have been some success stories of small contractors being set up, but any real changes will take at least 10 years. The small contractors tender on a labour based rate and the council provides the equipment and materials. The tenders are not awarded to the lowest bid. Awards are made to those contractors who have got closest to the estimate, (which is outside the financial regulations set by the government), but such a method is adopted to help the contractors get started. The council get around the financial regulations by calling the projects 'pilot'".

## Country L1

"The World Bank are pushing to privatise to make the organisations more efficient. Therefore efforts were being made to train contractors. Particularly in the Labour Construction Unit, where contracts were awarded to more than one contractor. In forcing people to go out and find jobs with contractors, the 'dead wood' often seen in government organisations should disappear. The dead wood does however appear to come at all levels in the organisation, not so much because people are lazy, but due to the fact they were allowed to carry on in what can only be described as an unprofessional manner, and there is apparently little chance of being disciplined and therefore no deterrent". The respondent gave examples of problems such as staff who are drunk on the job, and who fail to come to work because of being drunk etc.

## Country L1

"The development of private sector has been carried out, but even the building of the private organisation takes time. The contractors etc. are not queuing up to take on the work. In the country over 5 years, the private sector has been built up, what has made it less of a success, is the fact that the donor has said that the competitive bidding must be opened up, so there are large contractors from a neighbouring country waiting to bid against the new local contractors which will probably destroy the private sector which has been built up".



**Country M1**

"Districts are poorly equipped and manned. The National Road Authority will rely on the private sector to do the work. The small contractors are keen, but they cannot obtain equipment and they have no management skills. Free pilot courses to train contractors have been run, but future courses will probably have to be paid for, especially as the contractors will benefit - they should pay in the future. Plant availability is a really serious problem and the World Bank do not want to lend money to contractors to buy plant. It is intended to run a workshop to bring together the financial institutions and discuss a revolving fund which would allow contractors to procure plant. The working capital of contractors is also a problem. Many of the personnel are ex-ministry, but the contractors unfortunately lack management skills".

**Country M1**

"Funding from Japan is being used to assist small scale contractors and consultants. The NCIC (National Construction Industry Council) replaces the SCRB (Structural Consultants Registration Board). The NCIC is an autonomous body represented by industry. The contractors have to be registered and governed. The WB is also providing initial support. It is intended to divorce activities from the influence of government. Training for contractors is needed, as many of them have poor management skills, they have difficulty gaining access to bonds or collateral guarantees. The workload from ROMARP is earmarked for local small contractors to encourage their growth. Access to plant and equipment also needs to be facilitated. The hiring of equipment seems to be a more sensible option than buying it, as it brings down the overheads. A restructuring of equipment division is necessary, so that it can actually provide the required service. It should be a parastatal but competitive".

## 11. OUTSIDE INFLUENCE

*'The organisers (of the conference) were concerned that, whenever the implementation of maintenance management systems in developing countries was reported in journals or conference proceedings, consultants and developing country governments presented a picture of success that was not consistent with the observations of the World Bank..... A seminar was organised and ten international consultants were invited to report frankly their experiences, however, many chose to present success stories which were untrue'.<sup>59</sup>*

A respondent stated:

Activities can only be defined, if you only have a certain amount of money, how much should you do. Defining activities in maintenance is much harder than in construction. If you set maintenance according to activities, and it didn't rain and the grass didn't grow, then what is going to be done? The way a lot of people now think, given that an efficient force account system will never be able to be introduced. Budgets are too low, the GDP is \$200 per person. Does not matter how many systems you have, the money is simply not enough. So the money is wasted keeping the outward appearance that of how things work. 90% of the recurrent budget in Kenya goes to pay staff wages. In most countries with low GDP the same thing exists. There is no money left for anything else, including putting fuel in the vehicles. People want to give the impression that everything is OK, people will not admit they are in a disastrous organisation and nothing works. When the expatriate is there things will work, they have direct lines to the donor, if money goes missing they can shout and they are probably paid in the order of 1000 times more than the other staff, perhaps the engineers living on \$50 per month. It is an artificial situation.

*'...rapid expansion of the road system has taken place since the mid-seventies.....expansion has been largely driven by increasing donor involvement at the expense of adequate maintenance...'.<sup>60</sup>*

*'...it is generally true to say that under the conditions which existed at the start of the Project all donor initiatives in the roads sub-sector were seen by government as advantageous regardless of their content'.<sup>61</sup>* The problem goes hand in hand with the acceptance of technical publications as 'bibles', regardless of whether they are suitable.

*'Most of the conclusions are not new, indeed, many of them could and have been reached from the results of the numerous road projects undertaken prior to the inception of the MRCU. Nevertheless, for a variety of reasons, they have either been forgotten or found more convenient to ignore. The Consultants' view is that no harm and possibly some good may yet be produced by repeating them'.<sup>62</sup>*

*'...the MRCU Project is not about advising MOWT/DOR. In fact, it could well be said that the institution has had far too many advisors. Rather the Project aims to develop an environment in which the extensive local experience vested in MOWT/DOR can be pooled with the broader international experience of the expatriate members of the MRCU team'.<sup>63</sup>* Advise therefore is not what is needed, working from within, **promoting change** which has a far better chance of sustainability must be a more sensible way forward.

<sup>59</sup> ROBINSON, R., et al, Road Maintenance Projects, UNECA Fourth African Highway Maintenance Conference, Harare, 1987, p5

<sup>60</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p8.

<sup>61</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p25.

<sup>62</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p43.

<sup>63</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p47.

Aid projects are often quite independent of government constraints which may exist, therefore the experience gained cannot always be reproduced directly by the organisation itself.

*'..often there is polite acceptance of ideas or rationale presented by visitors from other countries'*<sup>64</sup>

Does the organisations receiving aid know what the problems are and what kind of help they need, does any one ask them what they need?

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<sup>64</sup> BUTLER, D.C., Analysis of simple manual maintenance prioritisation and its role in providing social political inputs in large network based programs, (MSc Thesis), 1995, II p3.

## 12. MANAGEMENT SYSTEMS

*'...a great deal of emphasis has been placed in many Bank-assisted projects on the application of modern management systems for planning, programming, budgeting, scheduling, control and data collection. It is hard to avoid the conclusion that it has often been overdone'.<sup>65</sup>*

A respondent commented:

"Everyone knows the details of how to do maintenance, and they are doing it, what a system will do is take that and assemble them in different ways. The systems are invented for the traditional council structure, everybody knows what they are supposed to do. A good structure, and in such situations it works, but even then the lengthmen know what they can get away with. What they can do to make it look like they have actually done something".

Country F1

A Road maintenance Management System (RMMS) system is used to record inventory, frequency of application of maintenance, to record the category of roads etc. It is used by the depots and divisions, but is not a system which allows prioritisation. Computers are not currently used in the depots, they operate a paper based system and supply the necessary information to the Division. The prioritisation is based on experience and a judgmental assessment. The computer based inventory system was developed by a local computer firm using the guidance of the maintenance engineers. This is perhaps a more effective method of developing a system, as it does not rely on a consultant coming in and amending an 'off the shelf' system. However, formal prioritisation in the form of a management system is about to be introduced by a consultant as the asset management element of FRUP III, but it will no doubt take a long time to take effect. Responsibility for the roads is very much with the maintenance engineers at present. The consultants are looking at a management system for the periodic activities only. It was felt this could be a waste of time as the allocation for the periodic maintenance is so small, and the engineer therefore wondered what use the new system could possibly be? The new system will require more than the current visual condition assessments to be undertaken, the engineer did not see how this could be achieved as it is difficult enough to get the resources to undertake visual condition assessments, let alone structural surveys.

Norms are not really used. The RMMS system uses data which is gathered on forms in each depot. The foreman or sirdar will record the hours worked by each level of staff on a road by road and day by day basis. This will include a break down of the plant and materials. This is split under the headings of Patching, Drainage, Sides etc. The information is fed into the RMMS which uses rates to give costs for the work. Unit rates have been produced for each division and depot based on the information from the RMMS. However the unit rates are not split by activity and cannot be directly compared as some of the activities may vary slightly from location to location. The cost of labour is the same in all divisions as that is set by PWD, the differences therefore reflect the different climates (it is dryer in the west) and the differences in frequencies and levels which this can introduce to the rates.

Unit rates taken from the Annual Road Maintenance Report 1997, Series No1, Historical:

<sup>65</sup> THE HIGHWAY MAINTENANCE PROBLEM and INTERNATIONAL ASSISTANCE, The World Bank, 1979, p25.

**Table 10 - Unit Rates**

Activity/ Unit Rate \$FJD	Central/ Eastern Div	Western Div	Northern Div
Patching	165/ tonne in place	147/tonne	160/tonne
Drainage	2000/km/ 500/km (Heavy/ Light)	426/km	350/km
Grading	70/km	51/km	45/km
Resheeting	15/km	10/km	11/km
Linemarking	600/km		
Sides	160/km	247/km	120/km

*'...there may be greater benefits to be obtained by improvements in the quality of the maintenance works through training, technical assistance, use of contractors, etc., than will be obtained by the introduction of management systems on their own. Ideally, both are needed together'.<sup>66</sup> Yet, even the organisations themselves may want high tech solutions, and encourage the consultants to deliver, when the capacity to sustain such systems does not exist.*

*'Modern management systems have potential in many developing countries but only if their objectives and benefits are clearly understood by the organisations and individuals who will operate them. Such systems must be appropriate to the country concerned and not just borrowed from another country where the maintenance, engineering, financial and social problems may be quite different. They must be introduced gradually, building on existing facilities and methods, rather than directly replacing them'.<sup>67</sup>*

*'...sophisticated management systems introduced by consultants.....some of these systems have failed to function properly, often because they have been too complex or have concentrated on collecting road condition reports rather than on ensuring the quality and quantity of the maintenance measures'.<sup>68</sup>*

If there is only sufficient money to 'fire fight' and respond to emergencies, why use a management system? The argument given would probably be that it would ensure the limited funds were spent as effectively as possible.

*'The basis of all management systems is reliable information.....with the response management adopted by DOR in the past there has been little need for management systems and hence information'.<sup>69</sup>*

<sup>66</sup> ROBINSON, R., Road maintenance planning and management for developing countries. Overseas Unit, 1986, Highways and Transportation 33 (60 8-13, (7) 4-10, p11.

<sup>67</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, A thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p4.

<sup>68</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p4.

<sup>69</sup> MRCU Phase 1 HMG/N ~ MRCU, Completion report Apr. 1997, p30.

**Country B1**

When asked about the initial reaction to the new MMS, my informant said he was always optimistic that it would work. It had been tailored to fit the country's needs and as they already had a system that was not very useful, and they seemed computer literate, it was a natural progression. Apparently, the supervisors will soon be inputting data themselves. When I asked if there would be any resistance to change, I was told that there would probably be some problems due to computer literacy, even amongst the engineers. The discussion turned to finance and it was noted that the accounts department did not use the system, or have any interest at all in its potential. It was rather surprising that the MMS team were producing the programmes and the justification for the budgets in a 'scientific' manner, and yet the people who actually dealt with the money were not interested at all.

An interesting point was made, which related to the crew cards being filled in by the supervisors. Apparently they do not always get filled in for each activity, and they are often filled in by the foreman, and not even to a very high standard. Another rumour, which cannot be substantiated, was that the Chief Engineer does not support the system particularly, however, the system is supported by the Deputy, who appears to be very switched on and proactive in his approach to maintenance. It was pointed out that there really was a need for a responsible person, such as a data input technician (for the MMS) in each district, but that was unlikely to occur, therefore it was necessary for the engineers to undertake the work. An interesting point was made about the re-prioritisation procedure undertaken by ROMAPS. Once the allocation has been made, (and it is significantly less), the system will take the actual allocation and re-prioritise the works accordingly. However, what may happen is that a road which perhaps had \$1000 allocated will be reduced to \$200, but the mobilisation of the men and equipment to carry out the work actually costs \$500. So the districts have to be careful and group together roads so that the mobilisation costs can be spread effectively. There is apparently no emergency allocation for maintenance, there is an allocation for natural disasters, but despite the fact that ROMAPS suggests 5%, there is in fact no allocation. If an emergency occurs, the district must carry out the works and apply for separate funding, if the works are large. Such requests are dealt with on an individual basis by the Ministry of Finance. My respondent told me that he felt the lack of funds would always be a major problem and however good the management system was, it couldn't magic up extra funding. However, he reasoned that the success of maintenance, relied on having key people that were interested and were able to give time to the subject. He was pleased with the MMS, and was satisfied that it had made a contribution to the effective running of the maintenance. He pointed out that the budget meeting with the Minister of Works, saw the Minister actually using the information produced by the MMS to prioritise the roads to meet with the budget. There are plans which show the roads maintained by the MoW, which were put together when the MMS system was introduced. However, no-one has taken responsibility for the up-dating of the maps, which are Autocad based. Therefore they will quickly become out of date.

Traffic counts - The counts are 12 hours 6am to 6pm for 7 days. The counters get no relief in the day, so they have to break the counts to take lunch and go to the toilet. The accuracy of the counts must be in question, especially on a road with low vehicles, it must be difficult just staying awake in the heat of the day!

A respondent commented:

“PMS systems allow a more professional argument about the distribution of funds to be made, and they can weigh up expansion, maintenance and traffic management. Thus, steering politicians to look good in ways other than through expansion of the road network”.

*‘Pavement management systems provide structured information that often is not widely available prior to the adoption and implementation of a PMS. Those who have been making decisions with less than complete information may resist implementation of a PMS because they fear that the PMS will show that their decisions were incorrect or less accurate than they had stated. they are afraid of possible censure or ridicule by their superiors or others in the organisation who now have ready access to pavement information’.*<sup>70</sup>

Country L1

“Even after the 5 years of input, the system may not actually be sustainable. Although the PMS staff have received on-going training, they never actually get beyond the input stage. For some reason they do not seem to understand the system in detail. The higher level engineers probably could, but they are working at a level which meant they do not have any involvement. Much is expected of graduate engineers, which is perhaps a contributory factor to the problem. In the UK, a fresh graduate would normally undergo some years of industrial training experience, where responsibility was introduced in a structured environment, however, it would appear that they are required to run before they can walk in the developing countries. The sustainability of the systems currently in use may in the end have to rely on ex-pat assistance to produce the yearly programme of works, simply because the type of issues which prevent the organisation from functioning in an effective way are part of the culture and will therefore only be overcome through years and years of slow development, you could liken it to evolution”.

*‘Modern management systems have potential in many developing countries but only if their objectives and benefits are clearly understood by the organisations and individuals who will operate them. Such systems must be appropriate to the country concerned and not just borrowed from another country where the maintenance, engineering, financial and social problems may be quite different. They must be introduced gradually, building on existing facilities and methods, rather than directly replacing them’.*<sup>71</sup>

<sup>70</sup> SMITH, Roger. E., & HALL, James. P., Overview of Institutional Issues in Pavement Management Implementation and Use, Conference proceedings, Third International conference on managing pavements, 1994, p55.

<sup>71</sup> JONES, T. E., Maintenance strategies for unpaved roads in developing countries with particular reference to grading and dragging, thesis submitted to the University of Birmingham for the Degree of Master of Science, 1983, p4.

**Country M1**

“It was pointed out that it is not appropriate to run sophisticated systems in small organisations. The National Roads Authority will eventually implement a system. But this will be carried out by EU funding which will be supplying technical assistance (via five people), for a period of 18 months. [2 people to look at management, 1 short term to develop the backlog maintenance program, 1 person to look at contract administration, and 1 person to develop a highway management system]. The old system (MARMS) in the MoWS used to work OK, with the regions feeding data into a data file and supplying it to HQ for processing. But the system was based on the force account system and so something new is now needed. With the force account system, there was sufficient money for wages and electricity, vehicles etc., but no money for work so the people and vehicles sat idle. The percentage of overhead costs would normally be 30% of the turnover, and with the NRA is expected to reduce to 10%. It is expected that the NRA will be responsible for the whole network. But it may delegate responsibility to other bodies. Perhaps regional management units (8) covering areas which are actually manageable. The NRA may also place people in the districts, who will help with the planning and monitoring of contracts”.



## Country M1

A member of staff demonstrated the road management system developed by DHV, based on DOS Dbase5. [Although the member of staff has been using the system for approx. 4 years, he was not actually very proficient in using the system, which it has to be said, was less than user friendly]. If an intelligent educated engineer has not managed to grasp the system fully, then what hope has a member of staff who has not received as much education. It was interesting to note that the game of patience was being played on the computer, which seems to be quite a common sight! The inventory is not fully up to date. The system is used to calculate the routine maintenance requirements and also the periodic. It would appear the system holds the inventory and then will specify the routine maintenance required in the city. The budget is based purely on the output of the system (i.e. it will tell the engineer what *should* be carried out each year, but that is unlikely to match up to what is *actually* carried out), and the routine maintenance is not based on condition assessment.

The city is split into 6 districts and all roads in the city are maintained by the council, there are also a number of sub districts. The council maintains the M roads (which used to be under the MoWS) but were handed over to the council, (but there appeared to be no extra money to help the council with their increased network). The roads are classified using a different system than the MoWS. The roads are classed as Collector, Distributor, Access and Residential. The hierarchy is used as a basis for allocation where possible, but it would appear political pressure is the main way of deciding which roads are maintained. Insufficient money is available for routine maintenance, Normally about 30% of the required budget is actually received. The print out from the system is used to decide what should be carried out on the ground, but obviously there is insufficient money to complete the desired works. 23 million units was needed this year and it was reduced to 6 million units. Drainage works are carried out as a priority and also pot hole patching. A bar chart is used to demonstrate to the politicians that they have a plan to work to, the Town Clerk and the City Engineer use the information to try and prevent the politicians from diverting funds, but it does not help when there is such pressure to complete maintenance on 'certain' roads.

A prioritisation system developed by BCEOM is used to apply points in accordance with road hierarchy and also for road condition, the higher the points the greater the need for work. Periodic works have not been carried out for many years because of lack of funds. NRA has provided some money for periodic maintenance in 1998, and the system is also apparently used to produce the list of roads which require periodic maintenance, however, as the condition assessments have not been carried out on a regular basis, the system is not used fully. There are only two staff to monitor the 480km of roads in the city and due to the lack of vehicles, they are unable to get out as much as they would like for supervision and assessment. They have a pool of vehicles and would like a vehicle to be designated for the roads team, but it hasn't happened, and they therefore have real problems getting around.

People do not tend to use the system as much as they should, there is only one computer and it means that the supervisors who are based in a depot, would have to travel to the City Engineer's office to use it, which they obviously do not. There are just not enough human resources. Performance standards and maintenance standards are on paper only, and the ones put forward by DHV are felt to be inappropriate **as they do not reflect the lack of resources and the sub-optimal conditions which exist**. Therefore the council have developed a lower set of standards, although they could not find a copy for us to look at! We therefore requested a copy of the standards and also a budget breakdown for the last year, showing roads and activities. They said they would supply it the next day, and print relevant information from the system. Unfortunately however, they were unable to supply any printouts.

**Country M1**

"The MARMS system is not used, one reason being that it requires a large amount of information to be gathered and there are insufficient human resources to undertake the work. Often only 1/10 of the budget is actually received. The M1 road is the main priority, yet there is even insufficient money for that road. Much of the maintenance budget goes on the structures. It is not unusual for allocations to be made and then withdrawn. Due to the exchange rate, the allocation received ten years ago, was actually more than the current allocation. (Especially if you consider the fact that the network has increased in size)".

**12.1. 'Black Boxes'**

*'The PMS software is considered a black box when it provides recommendations, but the rationale behind the recommendations is not known. ....In PMS, many early systems described the computer software as a PMS when in fact PMS is a concept that must be adopted by the entire organisations and the software is a decisions support tool'.<sup>72</sup>*

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<sup>72</sup> SMITH, Roger. E., & HALL, James. P., Overview of Institutional Issues in Pavement Management Implementation and Use, Conference proceedings, Third International conference on managing pavements, 1994, p58.



### 13. OWNERSHIP OF ROADS

A respondent commented:

"We are looking at the low end of things. There is the temptation to turn over the roads to the villagers. But if the road is 30k long (to get it to the nearest place) then how can a small village be expected to look after the road. The issue of ownership is being fought at the moment, is it the way forward for rural roads? There is an assumption that vehicles need to use the tracks. Access is not necessarily by vehicle, although the villagers may occasionally want to get on a bus, but maybe the bus company should look after the road, and be shown that they will make more money by putting something in to ensure access is maintained. What is beginning to happen, is model contracts,. You say to an area, 'the government can't afford to look after this road, but they are prepared to pay you to look after the road and to raise funds locally to help look after it'".

Country M1

"Roads were the domain of the MoWS/ MoLG, but the introduction of the National Roads Authority will change the situation. There is an attempt to designate roads to an owner, but there is no legal instrument to attach owners to roads, and without owners, the roads do not get maintained. The new roads Act in 1997 brought the NRA into existence. But the jurisdiction of the NRA stops at the designated roads".

#### 13.1. Road Users

*"In order to study the effect of road condition on road user costs, massive and expensive studies are needed".<sup>73</sup>*

A respondent commented:

"If you find a road in poor condition and you start doing something to it, you often find that while it is still being worked on, people will start using it, the buses will start running. The bus operator will think that the bus can now safely use the road, and he can then serve the population that needs transport".

#### 13.2. Community Participation

A respondent commented:

"In the country there is no money for any maintenance at all, nothing. Rural roads are being put in and there is no way government funds will be given for maintenance. But traffic counts revealed 1600 motorcycles a day, on a particular rural road. The place floods, so if that happens, the people have no access The economy is starting to grow slowly and the people really need access, so if you set up community road boards, you let them form their own organisations, the Asian Dev Bank is intending to give the money for maintenance to the community, and they have to raise a percentage themselves. The idea being at the end of the project (in 5 years) they should be in a position to pay for the maintenance. The institution should be in place. For the people in Cambodia they really need the access. In somewhere like Tanzania the distances are so great, you couldn't possibly raise the money in the same way".

<sup>73</sup> ROBINSON, R., Road maintenance planning and management for developing countries. Overseas Unit, 1986, Highways and Transportation 33 (60 8-13, (7) 4-10, p11.

## Country F1

It was felt that the country has gone beyond using labour based maintenance. It was pointed out that some villagers keep the vegetation down at the edges of their roads, but community maintenance is not felt to be necessary as there is sufficient money for routine maintenance and there is not such an equipment problem. As the work changes from direct labour to contractors there may be more of a problem as the small contractors do not necessarily have good equipment. Weeding contractors are however being used quite successfully, where villagers are employed to use hand tools to weed the edges (approximately 3m either side of the carriageway), sometimes 30 villagers can be seen working together.

## Country U1

"Private maintenance in 1993 of a hospital road in the country - Continued delays to the feeder road programme left this road in such a bad state that the local taxi operators got together to finance the employment of a team of labourers. Tools and a little technical advice were provided by the local Ministry of Local Government District Engineer, with day to day direction and supervision being achieved through the taxi drivers who plied the road. Within weeks of the scheme starting there was a marked improvement in the road, which was sustained and built on for some 6 months without any Government contributions. Then the scheme was dropped following interference by some officials who felt it was inappropriate, and who were not sympathetic to the idea that the contributions to road maintenance should be tax deductible. Finally the road was rehabilitated at very high cost, but with no follow on maintenance, and last I heard it is back to square one".

## Country U1

An interview with a respondent revealed: Community roads are built and maintained by the community, but when they are felt to be viable, they are taken over by the MoLG through it's district office. Each year some community roads are added to the network. Technical advice is given by the district with regard to building community roads. Hand tools are used. The road is classed as viable if it joins a school and village or perhaps a dispensary or local business centre. If the road is not considered viable then the local people maintain it. Although such a practice was apparently very common some years ago it has diminished as the younger generation have taken over. Now however a return to such a practice is being seen. Labour is given one day a week or month (the roads are generally earth roads). When the district takes over they may upgrade the earth roads to gravel. The total length of the network is increasing. The MoWTC provide some money for the maintenance of feeder roads through the conditional grant. The allocation is supposed to be matched by the district but it does not happen. The district formulates a quarterly plan of work and it is approved centrally at the MoWTC. A separate allocation is made for emergency work.

## Country B2

"Private maintenance in 1997 of some rural tracks in the country - a road that had been built and was then abandoned due to lack of maintenance. Within 100 metres of this road was a track heavily used by bicycles and motorbikes, this track was very well maintained through a locally initiated and locally financed initiative".

## Country N1

The District Development Committee has a committee structure. User Committees try to collect money from local people on a frontage or 'per house' basis, thus the people have a greater interest in the road, as they have contributed to it. There is pressure on the people to contribute when asked, otherwise they could easily become a 'social outcasts'. Setting up a 'maintenance committee' and employing a lengthman at a community level is a practical answer to the problem of maintenance of low cost roads, but only in areas where the population is high. Local communities often become involved in the maintenance of the bio-engineering works, as the advantages to them are obvious and 'ownership' is therefore promoted. Roads which are built by the division should perhaps be handed over to the District Development Committee and the Village Development Committee where appropriate and an amount of money should then be made available for the maintenance. Maintaining a road at the community level promotes ownership, and if the divisions can't undertake the maintenance themselves, then it is a possible answer.

## Country M1

"Donors promote community maintenance. There is a large EU funded project - Micro project programme. It responds to requests from the communities, who have to provide 25% of the resources for any work. This can be through labour. The unit who runs the project is not linked to the government (unlike MASAF) and they appear to be more successful. Each project is treated as an entity. The community puts the request forward through the local commissioner and they also nominate someone to run the project. The micro project unit will then order the materials and it is up to the local representative from the community to ensure the projects are started, and if they are not, the materials are taken back. The unit is autonomous from local government and the EU do not have any direct involvement. There is however a steering committee made up of ministry staff. Prior to 1994, the government had much more involvement and it was not as successful. A technical assistant helped, but the projects did not work as well, and it may have been the lack of ownership, because the projects may have been politically influenced, rather than being owned by the communities. MASAF has a large management structure and is apparently not as successful".

## Country M1

MASAF should be synchronised with the NRA. MASAF give wages instead of food. The repair of foot bridges, roads and small dams are carried out by the community. The construction of facilities by communities has helped to raise capacity. A minimum wage is paid. The issues of sustainability and ownership are very important. The problem with carrying out community maintenance of roads is due to the difficulty in identifying the users, unlike a water supply project or similar. Therefore people refuse to get involved and it does not work.

## Country M1

Apparently 'youth week' used to be quite successful. It involved the young people attached to a certain political group, they would be required to undertake a weeks worth of work once per year. But as the political party no longer exist, youth week has stopped. (It would be a good way to get some maintenance carried out though!). It was apparently quite successful.

## Country U1

An interview with a respondent revealed: The districts have little policy and community roads in particular are very political. The councillors generally want their community roads taken over (adopted). Community maintenance used to take place, but the people are no longer happy to do it. They pay taxes and they therefore think that some of the money they pay should go to the roads, and as a result they are not willing to give their labour for free.

## Country M1

"With regard to the MASAF principal, the community heads identify projects and a preliminary cost estimate is produced. Once approval from the steering committee has been given, the money is released to the district in tranches of 30%:40%:30%. However, there is little or no capacity within the district offices to manage the funds which are released to them. MASAF Public Works supervisors therefore work in 4 zones, each overseeing 6 districts. The district itself is made up of a District Commissioner, (who mobilises the community), a Clerk to the Council, (who undertakes the financial management) and a DRIMP supervisor. One problem with the arrangement of using the district staff for MASAF projects is that they are government paid, but are expected to work on the MASAF projects for no additional payment. (The idea is that it is in their interest to do so, as it benefits their district). However, as the districts are so poorly funded and equipped anyway, and sometimes the staff are not even paid their wages when money is short, it is of no surprise that they have not got the capacity to cope with the work MASAF requires them to undertake".

"If the capacity at the district level does not exist then contractors and consultants can be employed by MASAF. The districts have often complained that they are being overloaded. It is a difficult situation, as the district staff may actually sit with nothing to do for days and days, because there is no money to buy fuel for vehicles or to mend vehicles and buy materials, yet when they are required to undertake the MASAF schemes, which may be 15 schemes at once, they complain they can't cope. The financial management capabilities of the districts is often very poor, therefore there are 12 zone accounts assistants employed by MASAF, each having 2 districts to assist in book keeping etc. Delays in implementation of the MASAF projects has been noted due to the capability at the district level. Only one vehicle per district, which tends to be used by the District Commissioner, leaving the supervisors with no transport. MASAF have therefore had to provide some vehicle maintenance to ease the transport problem".

"Although MASAF can use contractors and consultants, when the districts lack capacity, the actual capabilities of the contractors and consultants at that level is also rather poor. At zone and national level, a database of contractors is held. The problem of equipment and vehicles is again a problem for such groups". "A final justification report is produced by the district, who are required to put the problems in writing. This is then sent to the MASAF zone office, verified and a completion notification is issued". "The new roads are constructed to DRIMP standards (Earth Roads)". The issue of maintenance now seems to be very significant and the respondent admitted that it posed a problem. "Communities were keen to build new roads. The road was a tangible and immediate, visible output of the work and effort put in. Maintenance however was far more difficult to see and was only *noticeable by its absence*. In the past they had constructed roads and perhaps assumed that the maintenance would follow, alas that has not been the case". Therefore they now intend to tackle the subject, although it is not going to be easy. With local leadership which was proactive, it was felt a maintenance committee could be formed. But could a committee actually do the job, are they financially capable? Are they technically capable? If so, all that could be achieved would be minor maintenance. [If people are struggling to buy food and to live, how interested are they likely to be in maintaining a road, the extra work will just make them more hungry, and they should not be expected to work for nothing. They are unlikely to understand the concept that a maintained road will ensure they have access to obtain food and water]. As part of the projects, small hand tools are purchased for the communities to use when building the

roads. The tools are then kept at the district offices and may be borrowed for maintenance. It was assumed in the past, that the roads built to DRIMP standard would be eventually designated by the government and would then become the governments responsibility. (They would maintain the structures and undertake the major maintenance). With the setting up of the NRA, the situation seems to be no more clear. The NRA only have to maintain the designated public roads, and there is unlikely to be any extra money available. (Especially considering that they need to find other sources of money in addition to the fuel levy, just to fund the current network). The NRA would now have to agree to designate the roads. Creation of facilities therefore seems too easy, and it is again the maintenance which causes a problem”.

There were no manuals available, apart from the DRIMP manual (which had already been obtained from ASIST). There was a guidance manual on concrete bridge decks, (because they are currently trying to change from timber bridge construction to concrete).

“Supervision of the community projects is carried out by the District supervisor, who will in turn train the foreman for the community (usually employed from the actual community). The foreman will then fill in a daily form to record who worked, and the supervisor will approve. The budget for the project covers tolls and promotes labour intensive practices”.

#### Country M1

A good suggestion was made, relating to the ‘youth week’. Why couldn’t the communities be encouraged to take part in a similar exercise where they are encouraged to give up a certain amount of time each year to carry out maintenance, it could be called ‘MASAF week’? The MASAF projects include 336 out of 379 which relate to roads, dams and forestation. There is much demand for the projects from communities, far more than they can cope with. [It is interesting to note the different approach taken to the Micro Projects (EU). Who rather than paying the community a minimum wage, simply provide the tools and materials and the communities have to provide the labour for free. The EU and MASAF both say their way is best. GTZ have also tried the food for work method, but this doesn’t always work, as people need the food before they work. Also the secure storage of the food, can apparently be difficult with such projects. When you bring large quantities of food in, you have to store it safely.

### 13.3. Infrastructure Development

*‘..the translation of the rural transport problem into that of a lack of roads and other physical infrastructure begs the question. Infrastructure only partially contributes to improving access and mobility. This presupposes that the traffic that might use it is already more or less queuing up to do so and rural economies are ready to respond’.*<sup>74</sup>

*‘The emphasis on investment in road infrastructure suggest an implicit assumption that private and public sector operators of transport services will respond efficiently to the opportunities opened up. One report went as far as complaining that: ‘The planners’ assumption must be that vehicles and transport services will materialise as if by magic’.*<sup>75</sup>

The fact is, that rural people cannot afford motor vehicles and often can’t even afford bicycles, so why build high quality roads? Agriculture is often quoted as a reason why roads are required, and for some this is true. For the majority however, far more simple requirements necessitate travel. *‘..to a greater or lesser extent, tasks relating to the meeting*

<sup>74</sup> IT TRANSPORT LTD., Promoting Intermediate Means of Transport, Approach Paper, Oct. 1996, SSATP Working Paper No 20, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p6.

<sup>75</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p60.



*of subsistence needs in the four study areas outweigh those relating to agriculture production and marketing'.<sup>76</sup>*

*'...water and firewood collection figure prominently in the transport workloads of many rural households'.<sup>77</sup>*

*'..only a small fraction of journeys made by rural people are outside the locality of their home village. Such journeys are rare in all of the study areas'.<sup>78</sup>*

*'Enhanced mobility, and provision of services and facilities, may be regarded as the two complementary elements of a comprehensive rural transport policy'.<sup>79</sup>*

*'Where the condition of a footpath or track makes travel difficult, slow or dangerous, improving it's condition would enhance mobility and could be expected to have a significant impact'.<sup>80</sup>*

*'...good road access broadens the economic opportunities available to rural people'.<sup>81</sup>*

Intermediate means of transport in Sub Saharan Africa are few. Should appropriate means of transport be treated with equal importance as the infrastructure they require?<sup>82</sup>

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<sup>76</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p31.

<sup>77</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p65.

<sup>78</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p32.

<sup>79</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p41.

<sup>80</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p55.

<sup>81</sup> BARWELL, Ian., Transport and the Village, Findings from African Village level travel and transport surveys and related studies, Oct. 1996, SSATP Working Paper No 23, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p48.

<sup>82</sup> IT TRANSPORT LTD., Promoting Intermediate Means of Transport, Approach Paper, Oct. 1996, SSATP Working Paper No 20, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa.

## 14. ACCESS FOR RURAL COMMUNITIES

*'Data collection for the purposes of rural transport analysis had conventionally consisted principally of roadside surveys, involving interviews with vehicle owners and other road users. This method had several drawbacks. First, by restricting its scope to road users, most rural dwellers, who make little or no use of motorized transports, were to a large extent excluded from the transport planning process'. (Kaira, K 1983).<sup>83</sup>*

Enhancing the mobility of rural people, but at the same time reducing the need for travel. The two issues must therefore be thought of as complimentary.<sup>84</sup>

*'...to continue to define rural transport in terms of 'roads' and 'motor vehicles' and to concentrate policies and investments on the development of rural road networks, is not enough'.<sup>85</sup>*

### 14.1. Accessibility

*'Broadening of the definition of the problem beyond 'mobility' to encompass the wider concept of 'accessibility'. In other words, the core problem should be seen as the scale and nature of the transport task rather than the inadequacy of the transport system per se'.<sup>86</sup>*

*'...a key issue is therefore to provide at minimum cost the necessary level of road access to meet specific transport needs'.<sup>87</sup>*

Also consider the option of reducing the need for rural travel and transport, the 'non-transport' options including the accessibility to facilities and storage, credit and provision. *'...storage facilities to be found at village level are insufficient for the needs of all farmers in the community. This leaves farmers little choice but to sell much of their produce at low prices at harvest time when there is a glut of crops on the market...'.<sup>88</sup>* Transporting of crops therefore adds to the rural transport infrastructure problems.

*'The function of roads is to facilitate the operation of transport services, and thereby to increase the mobility of rural people and to improve their access to facilities and services'.<sup>89</sup>*

<sup>83</sup> DAWSON, J., & BARWELL, I., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p7.

<sup>84</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p71.

<sup>85</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p74.

<sup>86</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p39.

<sup>87</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p57.

<sup>88</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p69.

<sup>89</sup> BARWELL, Ian., Transport and the Village, Findings from African Village level travel and transport surveys and related studies, Oct. 1996, SSATP Working Paper No 23, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p48.

A respondent commented:

"Many systems are based on roughness, but it has now been accepted that rural roads should not be measured using roughness. They should be measured on access, but how do you measure it? The WB want to put a number to it, so how do you put a value on peoples time, with regard to their accessibility. The IRFTD would say you go to a few villages and you find what people needs, their priorities etc., but if you are a district engineer in the MoW, and you go to a village and ask what are their main needs, you will probably find that their main needs are actually a water source, due to the fact they are headloading in and out of the water source. So the district engineer will find he can't actually help them with their main needs, i.e. that they need a closer water source. A roads authority can't deliver those type of needs, it is difficult to generalise, and this is why the roughness is used, it is quantifiable, it allows A and B to be compared. If, like the WB, you are putting in money, you do need numbers, so that you can quantify and justify what you give".

"The identification of constraints is a good idea, because it reinforces work that other people have done, and it could demonstrate that however much work you do, if the cash flow is not there, no system, however good will work. If there is not enough money for the supervision, how can you even gather the information to put into the computer system. Lack of capacity is due to many years spent without sufficient money. It is no good giving out money, if in 3 years it stops, the capacity won't have been built up. Road funds are now the idea because by seeing how much money can be raised (through putting a tax on fuel) and then handing that money over to an accountable organisation - private sector, you cut down on corruption".

"Is it possible to say that rural roads can't be maintained to an acceptable standard by road departments? Roads engineers are used to defining a standard by roughness, by design speed, by the fact that the same standard is apparent from start to finish. Standards such as that are not possible for low cost roads, and it is therefore difficult to assign maintenance activities, because the standards are lower. Definition of a road and basic access, how do you define it? All water crossings must work all the time? Steep slopes should be gravelled? No areas where vehicles would get bogged down? It is not even a lengthman issue, where the grass is cut all the way along. It doesn't even mean access all year, it may mean access 300/365 days. Close the road when it rains, to prevent damage by heavy vehicles. For example: to get from the south to the North in Mozambique, you have to drive into the other countries. A line of large trucks were passed while travelling on the road, the respondent came back four days later and the trucks had only moved 100km, and had destroyed the road in the process. Thus ruining the road for other vehicles such as buses etc. If a community is involved they will very often police the roads themselves, if they have the authority to prevent such occurrences".

"Every district is very different, how do you do it and how do you pay for it. Is it worth doing district level studies, are the findings relevant? Is one district representative of the country? You can't rely on spot improvements on main highways, otherwise people will die. On rural roads, the concern is not that people will die, but whether or not they have access. If doing the work (the maintenance) does not make any difference to the accessibility of the road, does it matter. A big study was carried out in Kenya to measure the difference that maintenance actually made, and in the end it was found that measuring the difference was impossible. There were only a very few places where it made a difference to accessibility".

## 15. TRANSPORT AND VEHICLES

*'IMT - intermediate, that is, between walking (with loads carried on the head) and conventional, expensive and high-capacity motor vehicles'.<sup>90</sup>*

Lack of awareness of IMT: *'Among policy makers, IMTs are often regarded as 'primitive', 'backward', or as being at best temporary palliatives which will rapidly be superseded by 'modern' motor vehicles'.<sup>91</sup>* However, many rural people do not have access to motor vehicles, which means they do not necessarily need roads which are maintained to a standard designed for such vehicles. It is reported that in SSA, there are few intermediate modes of transport between motor vehicles and walking. Even bicycles are out of the reach of many rural people, when you consider the retail price of a bicycle in Malawi was equivalent to 650 days work at the rural minimum wage (1998 figures).<sup>92</sup> Is it any wonder, that most people, apart from government officials and aid workers, do not have access to motor vehicles.

If motor vehicles exist in the locality, they may need to be able to reach the villages etc., especially if the vehicles are buses which serve local communities. Yet, do the roads need to be maintained to a high standard, where roughness is considered, or is the maintenance of accessibility sufficient when funds are scarce. *'It is, however, not the mere existence of a road, but its condition, which determines whether it is possible for motor vehicles to operate down to village level'.<sup>93</sup>*

The surveys discussed in the work by Dawson and Barwell, 'Roads are not enough' report the following statistics: The Ghana survey of nine villages (total population over 21,000) revealed a total of 10 motor vehicles. In Makete in Tanzania, (population approx. 13,700) only one household owned a motor vehicle and 3 owned motorcycles.<sup>94</sup> Obviously, the roads don't necessarily need to be maintained in a way which preserves access for motor vehicles. Such surveys are useful to demonstrate the point, but their applicability in general terms is less easy to define.

Just because a road is built, it does not mean there are vehicles waiting to use the road. *'Economic decisions to invest in rural road improvements should be made only after confirmation that existing transport services are available to operate on the roads, or that other measures will be adopted to develop such services'.<sup>95</sup>*

<sup>90</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p41.

<sup>91</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p44.

<sup>92</sup> IT Transport, Promoting Intermediate Means of Transport, Approach Paper, October 1996, p6, from Relf and Dixon-Fyle, 1988.

<sup>93</sup> BARWELL, Ian., Transport and the Village, Findings from African Village level travel and transport surveys and related studies, Oct. 1996, SSATP Working Paper No 23, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p51.

<sup>94</sup> BARWELL, I & DAWSON, J., Roads are not enough: new perspectives on rural transport planning in developing countries, London: Intermediate Technology, 1993, p15.

<sup>95</sup> BARWELL, Ian., Transport and the Village, Findings from African Village level travel and transport surveys and related studies, Oct. 1996, SSATP Working Paper No 23, Sub-Saharan Africa Transport Policy and Program. The World Bank and Economic Commission for Africa, p61.



## 16. THE RURAL POOR

*'Visitors tend to see, to meet, and to interact with, only the more influential and better off rural people'..... '...rural elite benefits disproportionately'<sup>96</sup>.*

If the aim is to benefit the rural poor, then why do we not speak to them? Probably because it is not something we have experience of doing. We leave it to those who have experience, but perhaps the answer is to start by speaking to those experts. *'Research priorities are determined not by scientists but by the poor themselves. Evaluation is not by peers but by clients. And not surprisingly, the status of many new professionals in the eyes of their peers, is low, if not off the bottom of the scale altogether'<sup>97</sup>.*

The following table is taken from an ASIST bulletin Number 6 (Sept 1997) and was originally sourced from the Human Development Report 1997, UNDP. It uses the Human Development Index (HDI) which is made up from a life expectancy index, education index and GDP, the resulting range is 1 = excellent and 0 = not developed. The other index used is the Human Poverty Index (HPI) which considers longevity, knowledge and living standards and is defined as the % of people regarded as poor.<sup>98</sup>

**Table 11 - HDI and HPI Values for a Selection of Countries**

Country	HDI value (1 = Excellent and 0 = not developed).	HPI value (% of poor as defined)
Botswana	0.673	22.9%
Ethiopia	0.244	56.2%
Eritrea	0.269	-
Ghana	0.468	32.6%
Kenya	0.463	26.1%
Lesotho	0.457	27.5%
Malawi	0.320	45.8%
Mozambique	0.281	50.1%
Namibia	0.570	45.1%
Nigeria	0.394	41.6%
South Africa	0.716	-
Sierra Leone	0.176	59.2%
Swaziland	0.582	-
Tanzania	0.357	39.7%
Uganda	0.329	41.3%
Zambia	0.369	35.1%
Zimbabwe	0.513	17.3%

<sup>96</sup> CHAMBERS, Robert., Challenging the professions, Frontiers for rural development, 1993, Intermediate Technology, p28.

<sup>97</sup> CHAMBERS, Robert., Challenging the professions, Frontiers for rural development, 1993, Intermediate Technology, p9.

<sup>98</sup> ASIST Bulletin No 6, Sept 1997, p24 [Sourced from Human Development Report 1997, UNDP].

'In the Himalayas, 500 miles of the highest road in the world is maintained by men and women using only hand tools. Weather conditions restrict them to the summer months. One in 20 will die; the rest will shorten their lives by 10 years. But this is not forced labour. Each year, scores of peasants trek over the mountains, drawn on the prospect of work – no matter what the cost'.<sup>99</sup>

It is reported that the road stretches between Manila and Karakoram Pass (border with China). The track is cleared and then sealed at a rate of 770ft/ day. Most of the work is undertaken by hand, however the military are allowed to use the equipment which does exist. The workers are either hired by the army or come from Nepal, and they receive clothes from the army. Working at a high altitude adds to the problem of sickness amongst the workers caused by under-nourishment. *'At the end of summer, workers spend their hard-earned rupees on clothes and food in the mountain village of Leh before the army takes them home'*.<sup>100</sup> The reality therefore, is that despite the conditions being extremely harsh and the potential of death and sickness being very high, people work on the road because it is their only source of income, and will hopefully see them through the winter months.

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<sup>99</sup> The Sunday Times Magazine, 18-10-98, 'A passage through India', pp40-47.

<sup>100</sup> The Sunday Times Magazine, 18-10-98, 'A passage through India', pp40-47.



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THE UNIVERSITY OF BIRMINGHAM  
and  
THE UNIVERSITY OF NOTTINGHAM



## Report I - Appendix II Addressing Maintenance Effectiveness



# Appropriate and Efficient Maintenance of Low Cost Rural Roads

## Report I - Appendix II Addressing Maintenance Effectiveness

February 2000

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**Department for International Development  
Knowledge and Research (KaR) Programme**

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<b><i>DFID Project Reference:</i></b>	R6852
<b><i>Subsector:</i></b>	<i>Transport</i>
<b><i>Theme:</i></b>	T2
<b>Element A:</b>	Review of Procedures, Standards and Methods
<b><i>Date:</i></b>	<i>February 2000</i>

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## **REPORT 1 ADDRESSING MAINTENANCE EFFECTIVENESS**

### **REPORT 1 APPENDIX II – COUNTRY QUESTIONNAIRES**

#### **Introduction to country questionnaires**

A questionnaire was produced which was broadly based on the following documents:

- Priorities for improving road maintenance overseas: a check-list for project assessment, Brooks, D.M., et al, Inst. Civ. Engrs, Part 1, 1989, 86, Dec, 1129-1141.
- Road Maintenance Projects, Robinson, R., Brooks, D.M., O'Sullivan, K., UNECA Fourth African Highway Maintenance Conference, Harare, 1987.
- Road Transport Research, OECD, Results of an inquiry concerning: The maintenance of unpaved roads in developing countries, 1987.

The purpose of using the questionnaire was twofold. Firstly, the aim was obviously to gather information, but perhaps more importantly, the aim was to ascertain whether questionnaires would in fact provide information that would be useful to the project, or whether interviews would actually reveal more interesting information. A copy of the blank questionnaire is provided, this is followed by the answers given by various experts pertinent to their countries – the answers have been rewritten into sentences under relevant headings for ease of reading. The names and the specific countries to which the answers apply have been omitted to protect anonymity. The persons approached to complete the questionnaire were experts from developing countries who were attending a residential course at the University of Birmingham in May 1998.





**1. SAMPLE OF THE QUESTIONNAIRE (MAY 1998)**

**INSTITUTIONAL CAPABILITY**

**General statistics**

What is the length of unpaved road in the whole country?.....

What is the percentage of unpaved road in the whole country?.....

What is the length of unpaved road maintained by the organisation?  
.....

Which categories of road are covered by the organisation (Main, Feeder, Village etc.).....

How much money was spent in the last financial year on routine maintenance procedures of unpaved roads? .....

How much money was spent in the last financial year on periodic maintenance procedures of unpaved roads? .....

**Maintenance manuals for unpaved roads**

Are publications such as the Overseas Road Notes 1 & 2 and PIARC International Road Maintenance Handbooks 1 - 4 well known within the country?

YES		NO	
-----	--	----	--

Who 'owns' a copy of the available manuals?

ENGINEERS (Chief or District Engineer and other Assistant Engineers)	OVERSEERS (Those who oversee the supervisors)	SUPERVISORS (Those who supervise direct labour or contractors)	LENGTHMEN

Has the organisation produced it's own maintenance manual?

YES		NO	
-----	--	----	--

If a maintenance manual for the organisation exists, was it produced with the help of an overseas consultant?

YES		NO	
-----	--	----	--

Please name the overseas consultant who helped produce the manual.  
.....

What does the manual cover?

TECHNIQUES (How to carry out the maintenance activities)	PLANNING (How the workload is developed)	PROGRAMMING (Scheduling of the work load)	MANAGEMENT (Management of staff, equipment)

**Budget - Routine maintenance for unpaved roads**

How is the budget for routine maintenance defined?

LINE ITEM (Budget is allocated to each individual task such as the activities involved in cleaning a culvert)	PROGRAMME (Budget is given as a lump sum and is programmed)	OTHER (Please specify)

How is the budget for routine maintenance split for approval?

BY ACTIVITY	GEOGRAPHICALLY	DEPARTMENTALLY	OTHER

In general terms, what percentage of the bid amount is actually?

0 - 9.9 %	10 - 39.9%	40 - 69.9%	70 - 100%

What method of release is adopted for the budget for routine maintenance?

MONTHLY	QUARTERLY	ANNUALLY	OTHER

Does the allocation of funds for routine maintenance arrive at the start of the expenditure period.

YES	NO	SOMETIMES

Does the method of routine maintenance budget allocation allow for the fact that there may be a skewed demand for funds, perhaps due to monsoons which may mean there are particular times when extra maintenance should be carried out?

YES	NO

In general terms what percentage of the allocation made for routine maintenance is actually spent?

0 - 9.9 %	10 - 39.9%	40 - 69.9%	70 - 100%

Is a carry over of routine maintenance funds allowed?

YES	NO

**Budget - Periodic maintenance for unpaved roads**

What percentage of the budget for periodic maintenance is met from loans and grants by international funding agencies?

0 - 9.9 %	10 - 39.9%	40 - 69.9%	70 - 100%

How is the budget for periodic maintenance defined?

LINE ITEM (Budget is allocated to each individual task such as the activities involved in regravelling)	PROGRAMME (Budget is given as a lump sum and is programmed)	OTHER (Please specify)

How is the budget for periodic maintenance split for approval?

BY ACTIVITY	GEOGRAPHICALLY	DEPARTMENTALLY	OTHER

What method of release is adopted for the budget for periodic maintenance?

MONTHLY	QUARTERLY	ANNUALLY	OTHER

Does the allocation of funds for periodic maintenance always arrive at the start of the period.

YES		NO	
-----	--	----	--

In general terms what percentage of the allocation made for periodic maintenance is actually spent?

0 - 9.9 %	10 - 39.9%	40 - 69.9%	70 - 100%

Does a budget allocation exist for emergency/ urgent maintenance?

YES		NO	
-----	--	----	--

**Budget - general (unpaved roads)**

Is the budget adequate to allow 'optimum maintenance' of unpaved roads to be executed?

YES		NO	
-----	--	----	--

Does the organisation use a maintenance management system for the management of unpaved roads?

YES		NO	
-----	--	----	--

Was the MMS introduced by an overseas consultant?

YES		NO	
-----	--	----	--

Please give the name of the consultant and the year the system was introduced.  
 .....

Is the MMS used on a regular basis to develop the budgets?

YES		NO	
-----	--	----	--

Is the MMS computerised?

YES		NO	
-----	--	----	--

Does the organisation use a bridge management system?

YES		NO	
-----	--	----	--

**Financial control**

Are any of the following methods used to raise maintenance money for unpaved roads?

ROAD FUND	TOLLS	OTHER

Are maintenance funds for unpaved roads allocated on the basis of:

PREVIOUS YEAR'S ESTIMATE	LENGTH OF ROAD PER DISTRICT	VOLUME OF TRAFFIC	OTHER

Are maintenance funds for unpaved roads spent by:

DIRECT LABOUR	CONTRACT	A COMBINATION

**MANAGERIAL CAPABILITY**

**Inventory (unpaved roads)**

Does an inventory for unpaved roads exist in the country?

YES		NO	
-----	--	----	--

Is the inventory for unpaved roads up to date?

YES		NO	
-----	--	----	--

When was the inventory for unpaved roads introduced?

<b>0 - 3 YEARS</b>	<b>OVER 3 YEARS</b>

Approximately what percentage of the network maintained by the organisation is unpaved?

<b>0 - 9.9 %</b>	<b>10 - 39.9%</b>	<b>40 - 69.9%</b>	<b>70 - 100%</b>

**Planning and programming of unpaved road maintenance**

Are there procedures (methods which must be followed) which govern how the organisation operates?

YES		NO	
-----	--	----	--

Which part of the organisation is responsible for the formulation of procedures?  
 .....

Is consideration given to long term planning, (3 or 5 year plans) with regard to unpaved roads?

YES		NO	
-----	--	----	--

Is traffic count data obtained for unpaved roads?

YES		NO	
-----	--	----	--

**Scheduling of works and operations**

Does the authority specify the amount of labour, material and equipment that should be used for various tasks, (such as in Government set **norms**)?

YES		NO	
-----	--	----	--

Are the norms workable?

YES		NO	
-----	--	----	--

Are budget allocations for routine and periodic maintenance interchangeable?

YES		NO	
-----	--	----	--

**Cost control**

Does the maintenance engineer inspect and audit the work?

YES		NO	
-----	--	----	--

Does the maintenance engineer measure the productivity of staff?

YES		NO	
-----	--	----	--

**Plant and equipment**

Are there procedures for daily operator maintenance of equipment?

YES		NO	
-----	--	----	--

Do the operators carry out regular maintenance of equipment?

YES		NO	
-----	--	----	--

Is the use of the machinery programmed to avoid over subscription?

YES		NO	
-----	--	----	--

Are the workshops adequately stocked with spare parts?

YES		NO	
-----	--	----	--

Do the vehicles and machinery often break down?

YES		NO	
-----	--	----	--

How long do repairs to vehicles/machinery normally take?

0 - 7 Days	8 - 31 Days	OVER ONE MONTH

Which machines are particularly problematic with regard to breakdowns? (Please specify).....

If specified, what is the apparent reason?.....

**TECHNICAL CAPABILITY**

**Condition assessment**

Are unpaved roads inspected systematically to determine the yearly maintenance requirements?

YES		NO	
-----	--	----	--

What frequency of inspection is used?

WEEKLY	MONTHLY	YEARLY	AD-HOC

Are staff trained to carry out inspections?

YES		NO	
-----	--	----	--

Are condition assessments visual or physical?

VISUAL		PHYSICAL		BOTH	
--------	--	----------	--	------	--

Is the condition assessment used for programming of work?

YES		NO	
-----	--	----	--

**Research and development**

Does the organisation undertake it's own research and development?

YES		NO	
-----	--	----	--

**Influence of Overseas Consultants**

Have any overseas consultants carried out assessments of the institutional, managerial and technical capabilities of the organisation?

YES		NO	
-----	--	----	--





## **2. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY B5**

### **2.1. Institutional Capability**

#### 2.1.1. Organisation

The Highway department has a structure defined in 5 directories and 22 regional districts. With regard to recent changes, the structure was redefined in Jan 1995.

#### 2.1.2. Administration

The department is responsible for state wide roads but not for federal and municipal roads. With regard to the strategic network/ hierarchy of roads, the federal roads are classed as the arterial principal roads in the state. State-wide roads are arterial secondary and also some feeder roads. With regard to unpaved roads, 100% of unpaved roads are maintained directly by the organisation, but this number will be decreasing by contracting maintenance of unpaved roads, because of lack of staff and equipment.

#### 2.1.3. Staffing Issues

The organisation has about 1600 employees. A clear definition of responsibilities/ job descriptions was set in Sept. 1996.

#### 2.1.4. Training

Training received by Engineers, Overseers etc. includes the use of computers, English courses, Spanish courses and others in each speciality area. The amount of training received by staff, depends on the interest of each employee. With regard to computer training, the training is given by local organisations and universities, using PC 486/ Pentium 100/ Pentium 133 etc.

#### 2.1.5. Supervisors

Field supervisors receive training in their area of action and other areas that they have an interest. The qualifications required by supervisors are a knowledge of the work. They supervise approx. 6 km and the works are contracts such as rehab.

#### 2.1.6. Budget

The preparation of the budget and allocation considers the restrictions of budget of state-wide government and according to conditions / population to benefit. The budget is not adequate. A maintenance administration system is used. The emphasis placed on maintenance is increasing. There is not system as yet which allows prioritisation to take place.

#### 2.1.7. Financial Control

The maintenance authority exercises full control of the budget, once it has been awarded. Whether or not a politician ask for money already allocated to maintenance to be returned for other works, such as new construction or emergency works depends on each case. The budget is split according to need. With regard to independent auditing, no measures apart from the state-wide accounting court is used. Internal audits are carried out for external roads programmes which are financed by bid. Tolls are not used to raise money. The organisation is using revenues obtained by charge of fines on the state-wide Roads.

### **2.2. Managerial Capability**

#### 2.2.1. Inventory (gravel roads)

An up to date inventory for gravel roads exists in the State. It covers: Size and length of roads, type of materials and thickness of layers etc. Approximately 45% of the network is unpaved.

### 2.2.2. Planning and Programming

Road hierarchy is not used as a basis for the allocation of resources and maintenance priorities. Work is programmed according firstly to maintenance of roads and then priorities of Central State Government. Consideration is not given at present to long term plans or network enhancement. New roads are not necessarily built with maintenance in mind. System such as HDM III are just beginning to be used. Traffic count data is obtained by manual counting every year, in a period of 3 days at 4 months of the year, expanded for each year. The actual standards and intervention levels achieved with level of skill available are fair to good.

### 2.2.3. Budgeting

The budget allocations for the different types of maintenance come from the same budget. The percentage of the budget is taken up by each class of maintenance activity: routine == 35% recurrent = 5%, periodic = 55% and emergency = 5%.

### 2.2.4. Cost Control.

The maintenance engineer inspects and audit the work. productivity of staff is normally measured by visual control. The sectors are requested to meet the standards.

### 2.2.5. Plant and Equipment

Equipment for the maintenance of unpaved roads is over 10 years old. The workshops are probably sufficiently stocked. Due to the age of the equipment, breakdowns occur, repairs can take from 1 week to 6 months depending on the breakdown.

## 2.3. Technical Capability

### 2.3.1. Planning

The road maintenance planning procedure is reviewed each year. Maintenance techniques are selected according to the majority of needs to carry out urgent works. the decision on the methods to be adopted is made by the maintenance director and the district managers. Communities are sometimes encouraged to participate in the maintenance of municipal roads, but not state roads. Contractors are also used. In general, unpaved roads maintained in a manner which aims to preserve the access for the public.

### 2.3.2. Contractors

Use is made of contractors for the maintenance activities carried out on unpaved roads - contracts for routine/ periodic maintenance. Contracting is feasible and qualified contractors are available. A national bidding system is used. Works are supervised by the road Dept, unacceptable works can't be paid and the contractors are requested to carry out remedial works. They can also be fined, depending on the case.

### 2.3.3. Materials

Materials sources are operated by the district staff. There is one central laboratory in the Capital's state and other in regions in which works are being carried out. Testing methods adopted are specified by the national highway dept.

### 2.3.4. Condition Assessment

Unpaved roads are inspected systematically each year to determine the yearly maintenance requirements. Regular checks of staff carrying out inspections are not made with any frequency. Condition assessments are normally visual.

### 2.3.5. Research and Development

Many sources of published research work are available in the country. the organisation does undertake some of its own research and development work.

### 2.3.6. Influence of Overseas Consultants

The organisation has developed some manuals and procedures with overseas consultants, in areas of projects - environment roads guidelines and pavement management etc.



### 3. INFORMATION OBTAINED FROM QUESTIONNAIRES COUNTRY E1

#### 3.1. Institutional capability

##### 3.1.1. Organisation

The structure of the organisation is on the verge of being finalised.

##### 3.1.2. Administration

The Roads Authority is only responsible for federal roads, the rural roads are under the jurisdiction of regional authorities. Very recently, a road functional classification has been carried out by a consultant. The lengths of unpaved roads varies from district to district, but may go as high as 90% and be as low as 50%.

##### 3.1.3. Staffing Issues

Staff number in the organisation - of the order 12,000 permanent and 8000/4000. A clear definition of each person's responsibilities within the chain of command is available, set by the Human Resources Dept.

##### 3.1.4. Training

Types of training include orientation (new staff), refresher and promotional. Training is held in the two training centres, duration varies from a few weeks to many months. Resistance to change by staff is inevitable. Computers are on the verge of being introduced.

##### 3.1.5. Supervisors

The qualifications which field supervisors need to demonstrate are set in personnel manuals. The length of road supervised varies: 150 - 300 + kms, and they supervise approx. 100 staff.

##### 3.1.6. Maintenance Manuals

There is a knowledge of technical publications such as the Overseas Road Notes 1 & 2 and PIARC Handbooks 1 - 4. The documents are kept in the library. The organisation has produced its own maintenance manual with the help of consultants.

Manuals were obtained from an outside body, (overseas consultant), but they are being updated now by in-house staff together with donor help. A lot of changes are being made to the manuals. Standard worksheets etc. are used at operations level and by the finance division.

##### 3.1.7. Budget

The preparation/ allocation of maintenance budgets is undertaken by length of section, type of pavement and standard. i.e. paved/ unpaved, main/rural road etc. The budget is only adequate to achieve accessibility and therefore the best use of what has been approved has to be made. Bids are made to the Council of Ministries through the Ministry of Economic development. The issue of placing too much emphasis on new construction is being rectified now. A system which allows prioritisation to take place has just begun.

##### 3.1.8. Financial Control

The maintenance authority exercises full control of the budget, once it has been awarded - monthly. A politician could not ask for money already allocated to maintenance to be returned for other works. The budget is split between routine, recurrent and periodic maintenance. The Auditor General undertakes independent audits and internal audits are undertaken by the Audits Division. Tolls are not used to raise money directly for road maintenance, however, a road fund is used.

### **3.2. Managerial capability**

#### 3.2.1. Inventory (gravel roads)

An up to date inventory for gravel roads does exist in the country and it covers: Drainage, pavement, structures and road furniture. Approximately 20% of the network is unpaved.

#### 3.2.2. Planning and Programming

Road hierarchy is used as a basis for the allocation of resources and maintenance priorities. The programming of work has just begun. Consideration is given to long term planning, (10 years) with regard to network enhancement. New roads built with maintenance in mind. The use of systems such as HDM-III has just begun. Traffic count data is obtained through the districts and it is up to date. The availability of maps and general road data for (construction, historic data etc.) is: Road data > 50%, Maps 100% The actual standards and intervention levels achieved with level of skill available are fair. The reasons for deviation from recommended management practice are funds and capacity limitations.

#### 3.2.3. Budgeting

The authority specifies the amount of labour, material and equipment that should be used for various tasks. Budget allocations for the different types of maintenance are interchangeable.

#### 3.2.4. Cost Control

The maintenance engineer inspects and audits the work. The he measures the productivity of staff in a crude way which is currently being refined. Nothing happens if the productivity does not meet the required standards, but now 'managing by objective' is being incorporated as a yardstick for work.

#### 3.2.5. Plant and Equipment

Strong direct labour exists for both routine, periodic and development works. The programmed use of machinery to avoid over subscription is now being refined. Spare parts for equipment are scarce. Some repairs can take as long as 6 months and others weeks, depending on spares.

### **3.3. Technical Capability**

#### 3.3.1. Planning

The road maintenance planning procedure is reviewed regularly. The maintenance techniques are selected from maintenance history of the section, and the traffic. The government makes the decision on which methods should be adopted as recommended by the organisation. Communities are involved in the maintenance of roads, but not in an organised manner, and only emergency works when called upon. There is scope for the engineer to use contractors for specific tasks such as development projects. The use of indigenous skills/ simple tools to encourage local community maintenance has just begun. In general, unpaved roads are maintained in a manner which aims to preserve access for the public.

#### 3.3.2. Contractors

The use of contractors is feasible. Contractors are vetted using a prequalification assessment. Consultants and counter part engineers from our organisation audit the work.

#### 3.3.3. Materials

The organisation operates the material sources and also different government and private enterprises. Both private and government laboratories exist in the country. Materials are normally compacted mechanically, and good quality materials are available. American testing standards are used.

#### 3.3.4. Condition Assessment

Unpaved roads are inspected randomly to determine the yearly maintenance requirements. Checks are rarely made of the staff by a trained supervisor. Condition assessments are visual but now a PMS branch is doing mechanised assessment.

#### 3.3.5. Research and Development

Published research work is not available in the country The organisation does not undertake it's own research and development.

#### 3.3.6. Influence of Overseas Consultants

The organisation does use manuals / procedures developed by overseas consultants specifically for use by the e.g.: CMS, MMS, EMS. The CMS and MMS partially successful and EMS unsuccessful. With regard to the EMS, it does not seem that the overseas consultants have carried out assessments of the institutional, managerial and technical capabilities of the organisation.





## 4. INFORMATION OBTAINED FROM QUESTIONNAIRES COUNTRY M1

### 4.1. Institutional Capability

#### 4.1.1. Organisation

There have been changes to the organisation in 1990.

#### 4.1.2. Administration

The road maintenance department is not responsible for all roads in the area. A hierarchy of roads been established. Approximately 65% of roads in each district, maintained by the organisation are unpaved. But there is a need to carry out a new inventory

#### 4.1.3. Staffing Issues

There is a clear definition of each person's responsibilities within the chain of command. Controlling officer with the approval of top management (professional) sets the responsibilities/ job descriptions.

#### 4.1.4. Training

The type of training received by staff is: 1). Engineer: for professional registration - Min 2 years in office and in field. 2). Overseers/ supervisors: in-house refresher courses - as and when required - at MoW training centre. The reaction of staff at all levels to changing conditions and work methods is all round resistance. Staff are trained to use computers - in house training by senior officers, for design and road management systems.

#### 4.1.5. Supervisors

Training provided for field supervisors includes - Training camps ( refresher courses and upgrading).Field supervisors are required to demonstrate high levels of qualifications. They are responsible for 200 - 250km of road and they supervise contractors.

#### 4.1.6. Maintenance Manuals

There is a knowledge of publications such as Overseas Roads Notes and the PIARC International Road Maintenance Handbooks, but they are not accessible. The manuals which are available are kept in a library and copied as needed. The organisation has it's own (jointly produced between consultants and the MoW), maintenance manual which covers: techniques, planning, programming, management. The manuals cover the required information, but could be improved to reflect new technology. Standard worksheets are used by middles and senior managers.

#### 4.1.7. Budget

The preparation/ allocation of maintenance budgets is undertaken by condition and population. The budget allocation is not even adequate to achieve accessibility. Therefore the organisation does what can be done with the available allocation. An MMS is not used to make planned bids for maintenance funds. Emphasis is not placed on new construction. A prioritisation system is not in place.

#### 4.1.8. Financial Control

The maintenance authority exercises full control of the budget, once it has been awarded - monthly. Politicians cannot ask for money already allocated for maintenance to be returned to carry out other works. The budget is split between routine, recurrent and periodic maintenance. An independent auditing procedure is not in place. Internal audits are however carried out by senior managers. Tolls are not used.

## **4.2. Managerial Capability**

### **4.2.1. Inventory (gravel roads)**

An inventory for gravel roads does exist in the country, but it needs to be revised. 80% of the network is unpaved.

### **4.2.2. Planning and Programming**

Road hierarchy is used as a basis for the allocation of resources and maintenance priorities. Work is rarely programmed according to defined priorities. Consideration given to long term planning, (3 or 5 year plans) with regard to network enhancement. New roads are built with maintenance in mind. Systems such as HDM-III are available and are used. Traffic count data is obtained in the field by traffic data collection teams and it is up to date. Maps and general road data are easily available from the library. The actual standards and intervention levels achieved with level of skill available are fair. The reason for deviation from recommended management practice is shortage of resources.

### **4.2.3. Budgeting**

The authority specifies the amount of labour, material and equipment that should be used for various tasks. Budget allocations for the different types of maintenance are sometimes interchangeable.

### **4.2.4. Cost Control**

The maintenance engineer inspects and audits the work. The maintenance engineer does not measure the productivity of staff. If the productivity does not meet the required standards, nothing happens.

### **4.2.5. Plant and Equipment**

Most equipment is hired. The use of equipment is programmed. Workshops are not adequately stocked, and broken down vehicles can take weeks to repair.

## **4.3. Technical Capability**

### **4.3.1. Planning**

The road maintenance planning procedure is reviewed every 6 months. The maintenance techniques selected depend on available resources. The decision on which methods should be adopted is made by the persons handling the work with approval from his senior. Village development councils undertake community participation. Formal tenders are used, where contractors are employed. Very much use is made of indigenous skills/ simple tools to encourage local community maintenance. Unpaved roads maintained in a manner which aims to preserve access.

### **4.3.2. Contractors**

The use of contractors is feasible for all the maintenance activities carried out on unpaved roads, but there are not sufficient contractors. Just started pre-qualifying but not for emergency works. The work of the contractor is audited through site inspection with a check list and protection is given through contract provisions, e.g.: retention money and performance bonds.

### **4.3.3. Materials**

Contractors operate the material sources, crushers and screens are used. Materials are normally compacted mechanically. There are 4 Government, 1 college and 2 consultant run laboratories in the country. British and American standards are used in the labs.

#### 4.3.4. Condition Assessment

Unpaved roads are inspected systematically twice a year to determine the yearly maintenance requirements. Staff are trained to carry out inspections and checks are made of their work by a supervisor. Condition assessments are visual.

#### 4.3.5. Research and Development

The organisation does not undertake it's own research and development.

#### 4.3.6. Influence of Overseas Consultants

The organisation does use manuals / procedures developed by overseas consultants specifically for use by the organisation. Overseas consultants have introduced both successful and unsuccessful practices. Assessments of the institutional, managerial and technical capabilities of the organisations have been carried out.



## 5. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY N1

### 5.1. Institutional Capability

#### 5.1.1. Organisation

The structure of the organisation (Department of Roads) - six regional road directorates which control 25 divisions. There have been no changes since 1993.

#### 5.1.2. Administration

The Dept of Roads is effectively responsible for the whole road system. However the Dept of Roads strategy is based on the assumption that responsibility of rural roads will be transformed to the Ministry of Local Development. The strategic network / hierarchy of roads has been established - a) National Highways, b) Feeder Roads (secondary roads) c) District Roads and d) Urban roads. National highways and Feeder Roads together form the strategic road network. Approximately 50% of unpaved roads, in each district are maintained by the organisation.

#### 5.1.3. Staffing Issues

There are nearly 500 graduate engineers, 1000 middle and lower level technicians and 500 admin. (permanent staff) within the organisation. Clear job descriptions are used at all levels. The Government sets the responsibilities and job descriptions on recommendation of the Ministry of General Administration.

#### 5.1.4. Training

Road sector skill development under the department identifies the training needs of the staff to be trained in the specific field and arranges the same accordingly, both inside and outside of the country. The number of days of training received by members of staff, all depends on the level of training and the level of the staff to be trained. Computers are being used for all road management works and training is given.

#### 5.1.5. Supervisors

Generally road maintenance and bio-engineering training is arranged for the field supervisors. Field supervisors need to demonstrate a High School certificate with professional training in road maintenance and construction etc. The length of road supervised depends on the location of the road such as mountainous, plain or unstable locations. In general each supervisor supervises 50 road workers.

#### 5.1.6. Maintenance Manuals

There is knowledge of technical publications such as the Overseas Road Notes 1 & 2 and PIARC Handbooks 1 - 4, and they are accessible to related persons: Engineers and overseers. The organisation has produced its own maintenance manual which covers: techniques and management. The manuals which are available within the organisation cover the required information, but they will need revision in the future. Standard worksheets and report sheets are used by the engineers.

#### 5.1.7. Budget

The preparation/ allocation of maintenance budgets is undertaken by condition, terrain. The budget is not adequate to allow optimum maintenance to be carried out. The bid is made according to budgetary allocations. The organisation makes bids to the Department of Roads based on planned maintenance. Too much emphasis is rarely placed on new construction. A computerised system is used to allow prioritisation to take place.

#### 5.1.8. Financial Control

The maintenance authority does exercise full control of the budget, once it has been awarded - quarterly. Politicians do not often ask for money already allocated to maintenance to be returned for other works, such as new construction. The budget is split between

routine, recurrent and periodic maintenance. An independent auditing procedure is carried out by the Auditor General. The organisation carries out internal audits using staff of the accountant general deputed to the Dept of Roads.. Tolls are used on a selection of highways only, but it is likely to be established on other roads as well in the near future. Presently, one section of the road is being used to raise toll charges: the toll collected is solely used for the maintenance of that particular section only of the road.

## **5.2. Managerial Capability**

### **5.2.1. Inventory (gravel roads)**

An inventory for gravel roads exists in the country and it is up to date on strategic road network only. The inventory covers all necessary items. Approximately 60% of the network is unpaved.

### **5.2.2. Planning and Programming**

Road hierarchy is used as a basis for the allocation of resources and maintenance priorities. Work is programmed according to defined priorities. Consideration is given to long term planning, with regard to network enhancement. In the last 4 years, roads have been built with maintenance in mind. (It was not in practice in the past). Systems such as HDM-III are available and has now been calibrated to our environment. Traffic count data is obtained using loggers, the data is up to date. Maps and general road data (construction, historic data etc.) are available. The actual standards and intervention levels achieved with level of skill available are fair. Recommended management practice is followed as much as possible, but there are deviations on some occasions due to financial, political and social constraints.

### **5.2.3. Budgeting**

The authority specifies the amount of labour, material and equipment that should be used for various tasks. Budget allocations for the different types of maintenance are not interchangeable.

### **5.2.4. Cost Control**

The maintenance engineer regularly inspects and audits work and measures productivity. If the productivity does not meet the required standards, modifications have to be made accordingly.

### **5.2.5. Plant and Equipment**

All types of vehicles, plant and equipment are available, depending on the type of activity to be executed. The organisation has good equipment and well managed heavy equipment division, with an adequate quantity of spare parts.

## **5.3. Technical Capability**

### **5.3.1. Planning**

The road maintenance planning procedure is reviewed regularly. Maintenance techniques are selected as per widely accepted normal practice. Authorised personnel (engineer) makes the decision on which methods should be adopted. The Ministry of Local Development deals with community participation programmes. Contractors are used where applicable. Use is made of indigenous skills/ simple tools to encourage local community maintenance. Unpaved roads are generally (but not always) maintained in a manner which aims to preserve the access for the public.

### **5.3.2. Contractors**

Contractors are used for periodic maintenance. Sufficient qualified contractors are available. Contractors are registered at different levels and categories such as class 1,2,3 etc. according to their capability. The measures which exist to protect the client if the contractor's work is unsatisfactory include penalisation according to rules and regulations.

### 5.3.3. Materials

Contractors operate the material sources and crushers and screens widely used in all works. Materials are normally compacted mechanically. Many laboratories exist in the country using both British and American testing standards.

### 5.3.4. Condition Assessment

There are no set frequencies for inspections of unpaved roads, inspections are made as and when required. Staff are trained to carry out inspections, and regular checks made of the staff by a trained supervisor or engineer.

### 5.3.5. Influence of Overseas Consultants

The organisation does not use any manuals or procedures developed by overseas consultants they develop their own, they do not import. The organisation does not allow overseas consultants to introduce their practices on their own.





## 6. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY N2

### 6.1. Institutional Capability

#### 6.1.1. Organisation

The structure of the organisation is defined as: Central or Federal arrangement with operational offices at the state and zonal levels. There have been no recent reforms.

#### 6.1.2. Administration

The Federal Road Maintenance Department is responsible for only Federal Roads throughout the country. The roads in the country are grouped into three categories:

Federal  
State  
Local Government Roads

Approximately 3% of unpaved roads in the districts are maintained by the organisation..

#### 6.1.3. Staffing Issues

The staff at each level within the organisation are roughly:

450 Engineers }  
250 Technologists } all under permanent employment  
700 Technical Assistants and Chainmen }

There are also a number of labourers employed on a temporary basis, especially on projects.

Job descriptions are used in the organisation. These are already set down but are subject to the discretion of the Director Federal Highways who is the head of the department.

#### 6.1.4. Training

Training is in the form of in-service post graduate training in Universities, locally and abroad. Local and international workshops and seminars and conferences for the engineers and technologists is received. Technical assistants are usually trained in the three Highway Training Schools established by the Department across the country. The length of training period varies by at the highway training schools, it is usually a 9 month programme. Some categories of staff such as engineers and technologists are trained to use computers for word processing and engineering design.

With regard to resistance to change, it is usually welcomed by staff so long as it is perceived it will lead to a greater efficiency.

#### 6.1.5. Supervisors

Training provided for supervisors includes: materials testing, engineering surveying and general quality control. Supervisors should be engineers registered with the Council for the Regulation of Engineering in the country. They are also required to have worked under more senior engineers on a number of other projects. The supervisors usually supervise between 20 - 100km, depending on the scope of work to be carried out. The number of staff supervised varies according to scope of works to be carried out, but usually between 10 and 30 staff (senior and junior).

#### 6.1.6. Maintenance Manuals

Technical publications such as the Overseas Road Notes and the PIARC Handbooks are known, but they are not easily accessible these days. The manuals are usually owned by the department and are available to the staff who need them. The organisation has produced it's own manuals: Highway Design Manual, Specifications for Roads and Bridges and general conditions of contract. They were conceived within the organisation and produced with the

assistance of some consultants. The manuals have just been recently revised and cover all the required information. There are no international manuals which are completely inappropriate. Standard worksheets and forms are used by the field engineers.

#### 6.1.7. Budget

The preparation and allocation of maintenance budgets is undertaken on the basis of maintenance need. The allocation is never adequate to carry out the necessary maintenance. At times it is not even enough to ensure accessibility. There is really no planned maintenance management system, and no system which allows prioritisation to take place. What is executed depends on the budget available or expected and the roads that are most in need of maintenance are considered. It was true in the late 70's and early 80's, that too much emphasis was placed on new construction. Now new construction is being de-emphasised, but the available funds are still not adequate for maintenance.

#### 6.1.8. Financial Control

The budgets are awarded quarterly, but the Department has no control over the budget once it has been allocated. A politician could ask for money already allocated to maintenance to be returned for other works, such as new construction or emergency works. The budget is split between routine, recurrent and periodic maintenance. With regard to independent auditing, there is a Project Monitoring Unit in the office of the Honourable Minister of Works and Housing. Also maintenance projects funded by Donor Agencies have independent technical and financial auditing procedures. Internal audits are undertaken by the Project Evaluation and Review Unit under the Director Federal Highway's office. Tolls are used to raise money directly for road maintenance. Money from Donor Agencies is also used to pay for maintenance.

### 6.2. Managerial Capability

#### 6.2.1. Inventory (gravel roads)

An inventory, covering all roads in the country, exists and it is up to date from Federal Trunk Road Study carried out a few years ago. Approximately 80% of the network is unpaved.

#### 6.2.2. Planning and Programming

Road hierarchy is not used as a basis for the allocation of resources and maintenance priorities. With regard to programming of work, priority is need based on road condition and perhaps political expediency. Consideration is not really given to long term planning, but roads are built with maintenance in mind. System such as HDM III are available but are hardly used. Traffic count data is obtained by automatic and manual means, and maps and general road data are usually available. The actual standards and intervention levels achieved with the level of skill available is good. The reasons for deviation from recommended management practice are perhaps: inadequate financial provisions and political reasons.

#### 6.2.3. Budgeting

The authority does specify the amount of labour, material and equipment that should be used for various tasks. The budget allocations for the different types of maintenance are interchangeable. The percentage of the budget taken up by each class of maintenance is approximately:

Routine	=	30%
Recurrent	=	10%
Periodic	=	15%
Emergency	=	45%

#### 6.2.4. Cost Control

The maintenance engineer does inspect and audit the work and measures the productivity of staff through their achievements in the field. If productivity does not meet the required standards, it is reflected in the Annual Performance Evaluation Report (APER) of the staff.

### 6.2.5. Plant and Equipment

Approximately what number/ type of vehicles are available?

The plant and equipment available includes: Asphalt plants; Various grades of Dozers; Graders; Excavators; Rollers and Compactors; Water Tankers; Concrete mixers; Tar Boilers; Pavers. However, most of the works are executed by contract. the use of equipment is not programmed. the workshops and stores are not adequately stocked, and vehicles often breakdown, with repairs taking as long as it takes to secure funds.

## 6.3. Technical Capability

### 6.3.1. Planning

The road maintenance planning procedure is reviewed regularly. Direct labour and maintenance by contract are used. The Director Federal Highways makes the decision on which methods should be adopted, with the approval of the Honourable Minister of Works and Housing. Community participation is not encouraged, neither is the use of indigenous skills or simple tools. Contractors are however used. In general, unpaved roads are maintained in a manner which aims to preserve access for the public.

### 6.3.2. Contractors

Use is made of contractors for activities such as vegetation control and desilting of road crossing structures. There are sufficient qualified contractors available. Contractors are vetted on the basis of competence based mostly on past performance, plant and equipment holding, competitiveness of rates, completion period, location, experience of staff etc.

### 6.3.3. Materials

British and American standards are used for materials testing. Sometimes haulage distance causes a problem with an average haul distance of around 5km. Good quality materials are available in most parts of the country.

### 6.3.4. Condition Assessment

Unpaved roads are inspected quarterly to determine the yearly maintenance requirements. Staff are trained to carry out inspections, and regular checks are made of the staff by a trained supervisor or engineer. Condition assessments are both visual and physical.

### 6.3.5. Research and Development

The availability in the country of published research work is very scanty. The organisation does however undertake it's own research and development.

### 6.3.6. Influence of Overseas Consultants

The organisation uses some procedures developed by overseas consultants specifically for use by the organisation: some materials and pavement testing methods introduced by Messrs Texas Research and Development Foundation (TRDF), Austin, Texas. Also, some maintenance practices and the setting up of highway training schools by Messrs Kampsax. Overseas consultants have carried out assessments of the institutional, managerial and technical capabilities of the organisation prior to implementation of new techniques.



## 7. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY T1

Three questionnaire filled in by different people, where different view points exist they are detailed as (1), (2), (3).

### 7.1. Institutional capability

#### 7.1.1. Organisation

(3). The structure of the MoW - with directorates of Trunk Roads and Rural roads, the Ministry also has departments of planning, manpower, development and management and agencies i.e. building supplies and electrical and mechanical.

(3). With regard to changes and reforms - there are changes still taking place to separate administration and management and execution parts of the dept of roads.

#### 7.1.2. Administration

(1). District roads under the Prime Ministers office (PMO)

(3). Directorate of Trunk roads is responsible for all trunk roads while directorate of rural roads is responsible for regional roads and some essential district and feeder roads. Other roads fall under urban and district authorities. Strategic network at the moment is comprised of trunk roads and rural roads of about 34,000km. The lengths of roads maintained by the organisation are approx.: 5,300km of trunk roads and 24,000km of rural roads in 20 regions.

(1). Roughly 1000km of unpaved roads in each district.

#### 7.1.3. Staffing issues

(2). All staff now permanently employed. Regional employees approx.: 30

(3). At HQ under both trunk and rural roads there are 2 directors, 2 chief supervisors, 2 senior engineers and 6 maintenance/ construction operation engineers, the 20 regions have at least 5 engineers dealing with roads.

(1). There is a clear definition of each person's responsibilities within the chain of command.

(2). There is not a clear definition of each person's responsibilities within the chain of command. They are set by the Civil Service Dept - through the Ministry's Director of Personnel and Administration.

(3). There are job descriptions for engineers at all levels. A consultant was procured to provide job descriptions.

#### 7.1.4. Training

(1). Training received by Engineers, Supervisors etc. includes: workshops and seminars etc. held within and outside the country. Length of training is mostly 2-4 weeks. With regard to the reaction to changing conditions, the staff hope changes will improve and increase their living standards. Computers have been introduced recently, and staff are trained at the institutes.

(2). Engineers have management training at International Institutions. Overseers and Supervisors: Trade advancement courses at the MoW institutes. The length of training is variable and not systematic. With regard to the reaction to changing conditions, change is accepted readily if promotion is offered to better areas. Otherwise, staff show resistance by lobbying for better positions, this is seen at ALL levels. Staff trained by consultants (if available) to use computers, otherwise at private institutions. Computers are used for mainly data storage and reports, docs and preparation.

(3). Engineers receive post graduate and on the job training, internal and abroad. Overseers and supervisors get on the job training within the ministry's institutes, labourers and

lengthmen receive training within the regional engineers office. The length of training: min 1 year for post graduate studies. 3 months full time for technicians and overseers. Average of 2 weeks for on the job training of engineers. With regard to the reaction to changing conditions, staff show no resistance to change, but because the contractors at present are less experienced, the technicians find themselves trying to teach contractors how to do the work. With respect to the use of computers: most engineers and some technicians are being trained in some mushrooming computer schools.

#### 7.1.5. Supervisors

(1). With regard to training provided for field supervisors, generally, the supervisors must be engineers. They supervise approx. 200km of road, and sometimes more, with about 10 staff at Ministry HQ.

(2). The supervisors attend foremanship courses and must hold a technicians certificate. They supervise 200km of road, and they supervise contractors.

(3). Technicians and supervisors are taught how to physically attend a maintenance problem, the measures to be used and reporting progress. Most supervisors hold a Civil Engineering Full Technician certificate. They supervise about 150km of road, depending on the location. They supervise: about 2 assistant technicians and contractors, also depends on the magnitude and nature of maintenance activity.

#### 7.1.6. Maintenance Manuals

(1/2) There is no general knowledge of technical publications such as the Overseas Road Notes and the PIARC Handbooks. The Principal Secretary of the MoW 'owns' a copy of the manuals and there are 4 copies for the engineers at MoW HQ.

(3). There are some maintenance manuals at HQ (UNESCO publications) and there are sets at each of the 20 regions. The Regional engineers/ overseers and supervisors could own copies but there are not enough to go around.

(1). With regard to the organisation producing it's own manual: it covers mostly civil works, it was not obtained from an outside body and it is indeed useful. They cover the required info, but maybe some changes will be required in time. Standard worksheets etc. are not used.

(2). The organisation is in the process of producing a manual for techniques. It is being prepared by Technical Assistants in collaboration with local staff. Expected to be OK. The information contained in the manual is sufficient, however, the implementation is what is lacking. Road note manuals are useful. But some standards should be adjusted to fit local conditions and capacity. Standard worksheets are not used.

(3).The MoW has some manuals on standards and techniques. Some through technical advisors (e.g.: Swiss Dev Corporation) and others from neighbouring countries - MoW Kenya and also SADC. Most cover the required information all combined together, the problem is they are not sufficient. Most international manuals are appropriate. Traffic count sheets, PMS sheets and road condition survey sheets.

#### 7.1.7. Budget

(1). The preparation of budget considers condition, ADT and terrain, the budget is just enough to provide accessibility. If the allocation is less than bid, then the most important activities such as routine, spot improvements and emergency works are undertaken. New construction is mostly carried out under new construction loans. With regard to prioritisation, the priority is to make sure that the paved roads which are in good condition get routine maintenance 100%.

(2). The preparation of the budget considers ADT, but emergency works are an exception. Optimum maintenance is not achieved, accessibility is considered accordingly. If the allocation is less than the bid, the Regional Engineers re-schedule work accordingly. There

is no MMS in place, the bids are based on the assessment of condition. Too much emphasis is possibly placed on new construction, as the districts insist on reconstruction of marginally deteriorated roads at the expense of maintaining better roads. A manual guideline exists for prioritisation is available, but is hardly used.

(3). With regard to the preparation of the budget: trunk roads ADT/ condition survey and for rural roads - prioritisation by IRP, population and regional balance criteria. The budget is not enough to allow optimum maintenance. Money is not enough for accessibility, especially since 199?, between 1990-1995, accessibility was improved. If the allocation is less than the bid, the scope of the works have to be negotiated, to match the available budget. The bids are made based on planned maintenance using a custom made budgeting and action plans, as well as a program road mentor developed by TRL. The emphasis is on maintenance, rather than new construction, but budget difficulties as from 1995 have affected maintenance to a great extent. Prioritisation is usually done manually especially for rural roads, using a well developed prioritisation criteria.

#### 7.1.8. Financial Control

(1). With regard to politicians asking for money to be returned for use on other projects, it does happen, but mostly as payment for certificates of new construction to be reimbursed later. The budget is split between routine, periodic, recurrent and emergency maintenance. Independent auditors are used. A Road Fund e.g.: a fuel levy is used to raise money for road maintenance. Tolls are not used.

(2). The budget is delegated to the control of the regional engineers, the budget is awarded monthly. Politicians can ask for money already allocated to maintenance to be returned for other works through the regional commissioner, who is the Chairman of the Regional Roads Board. The budget is split between routine, periodic, recurrent and emergency maintenance. Government auditors are used, (government internal auditors stationed in regions carry out the task). Road tolls are not used, but a Road Fund, e.g.: fuel levy which gives a substantial improvement to the fund availability compared to the original arrangement where funds came from the consolidated government revenue.

(3). The maintenance authority does not have full control of the budget, funds are released monthly, in the past there have been irregular payments and under funding by the MoF. It is not possible, for politicians to ask for money to be returned, but funds in the past have not been released as per the budget. Efforts are underway to ring fence the road fund by legislation. The budget is split between routine, periodic, recurrent and emergency maintenance. The auditing is performed by internal auditors of MoW and external auditors from auditor general. The Ministry carry out internal auditing using works inspectorate (technical) and also chief internal auditor (internal). Road tolls are not used, but a fuel tariff is used, which is successful at the moment.

## 7.2. Managerial Capability

### 7.2.1. Inventory (gravel roads)

(2/3). An inventory exists, dating back to 1996. It covers: length, road geometry, road structures, surface type, date of construction. There are plans to extend the inventory through the development of a maintenance system (road mentor). 80% of the network is unpaved. The core strategic network is the responsibility of the MoW.

### 7.2.2. Planning and Programming

(1/2/3) Road hierarchy is one of the criteria used for the allocation of resources, trunk roads (10,300km) get 55% of maintenance funds, whereas rural roads (24,700km) get 45%. The work is programmed according to defined priorities. Newly rehabilitated roads in very good condition receives full maintenance funding, others are provided according to condition, bad roads receive only spot improvements. (2) Criteria not always adhered to.

(1). Consideration is given to long term planning (network enhancement), through a rolling plan.

(2). Consideration is not given to long term planning, due to lack of funds. New roads are built with maintenance in mind. Systems such as HDM III are available only at head office. With regard to traffic count data, the Regions are supposed to conduct 14 day traffic counts twice annually. Maps are fairly available but historical data is not well kept for ready reference. The actual standards achieved with the level of skill available are fair. The possible reasons for deviation from recommended practice are issues such as: lack of established systems; lack of resources, money, equipment, skilled and qualified staff; lack of seriousness.

(3). Currently, the organisation have engaged a consultant to study a 10 year roads sector investment plan. The upgrading of roads is undertaken after feasibility studies and detailed design. HDM III and RTIM3 are available, and are mainly used for economic analysis of road projects. Traffic counts are conducted by Regional Engineer's offices under predetermined counting stations under the supervision of the planning division, data available up to 1996. Maps are available in the maps division of the Ministry of Lands. But general road data is not available. Some data is available within the MoW Management Action Group (MAG). The actual standards achieved with the level of skill available are fair, local contractors are being involved and are currently being trained by the National Construction Council. Sometimes budget limitations result in postponement of periodic maintenance.

#### 7.2.3. Budgeting

(1). The organisation tries to specify the amount of labour, materials etc. that should be used for various tasks. Budget allocations are not interchangeable.

(2). Bids prepared by regional engineers in the form of contracts. Budget allocations are interchangeable. the approx.: percentage of the budget taken up by each class of maintenance is: Routine - 60%; recurrent - 20%; periodic - 10%; emergency - 10%.

(3). The organisation tries to implement performance budgeting but frequent, unforeseen budget cuts during implementation have been discouraging. Budget allocations are interchangeable, if it suits the Regional Engineer, but approval from HQ is sometimes necessary. Routine maintenance is given priority over other types of maintenance.

#### 7.2.4. Cost Control

(1/2/3). The maintenance engineer inspects and audits the work.

(1). The maintenance engineer measures the productivity of staff through man days. If the productivity does not meet the required standards, the maintenance engineer reduces the labour or increases depending on the extent of the work.

(2). The maintenance engineer has no system for measuring the productivity of staff..

(3). The maintenance engineer checks the productivity of contractors, through checking the quality of work done. If the work does not meet the required standard, the work performed is rejected, and the supervisor gets demoted.

#### 7.2.5. Plant and Equipment

(1). With regard to the numbers/ types of equipment available, mostly all parts and equipment are under the parastatal organisation. Vehicles often break down and repairs take too long, due to the ordering of parts from abroad.

(2). With regard to the numbers/ types of equipment available, there are about 3 inspection vehicles per region. Presently, most officers do not have their own equipment. Workshops and stores are not adequately stock, and items are purchased as necessary. Vehicles often break down and depending on availability of funds, the repairs may take an average of 2 weeks.



(3). With regard to the numbers/ types of equipment available, there is old equipment of different makes and numbers available through plant hire companies owned by the Government. Light equipment for maintenance of paved trunk roads are available in regions for hire. Since equipment is on hire basis, there are limitations that prohibit over subscriptions. Workshops and stores are not adequately stocked. Most of the vehicles now in the ministry are 8 years old, and are not economical.

### 7.3. Technical Capability

#### 7.3.1. Planning

(1). The road maintenance planning procedure is reviewed once a year, due to lack of funds.

(2). The road maintenance planning procedure is not regularly reviewed. Maintenance techniques are selected based on historical trends. the Regional Engineers make the decision on the methods to be adopted. Community participation is only called in during emergencies. Engineers usually use contractors. There is a formal tender procedure and depending on the site / project higher level supervision may be provided. Some labour-based pilot projects are in progress, which use indigenous skills and simple tools. Unpaved roads are maintained in a manner which aims to preserve access, however, periodic maintenance projects are done according to standards and specifications.

(3). The road maintenance planning procedure is reviewed regularly. Maintenance techniques are selected based on need, terrain, budget etc. Trunk/ rural roads engineers select the methods to be adopted, in collaboration with regional engineers. Some regions encourage community participation by providing maintenance contracts to villages close to some rural roads. The regional engineers through regional tender boards award maintenance contracts using standard bidding documents for minor works where the value does not exceed a set limit. Some use is made of indigenous skill and simple tools to encourage community participation. In general, unpaved roads are maintained in a manner which aims to preserve access.

#### 7.3.2. Contractors

(1/2/3). Local contractors are trained and used to maintain the road network especially routine and periodic. The work of the contractors is supervised by the road Dept, unacceptable works can't be paid and the contractors are requested to carry out remedial works. They can also be fined, depending on the case.

(2). The use of contractors is feasible, but about 30% of the regions do not have enough qualified contractors. Public tendering, pre-qualification are carried out by MoW centrally. Auditors from HQ carry out the auditing of contractors, if the work is unsatisfactory, the regional engineer is answerable.

(3). Contractors still lack basic qualifications and capabilities in terms of technical and equipment, there is a training programme going on under the national construction council. Contractors are classified depending on their capabilities. The classification is done by the national construction council/ board of contractors and the list distributed to various implementing (?) agencies by regional engineers. For large contracts, a consultant is procured for supervision, for minor works payment is made after approval by inspection committee of the regional engineers' office, the road board for the regions are also involved. Works inspectorate sections of the ministry carry out inspections. If work unsatisfactory, no payment is made.

#### 7.3.3. Materials

(1). The district staff operate the material sources. There is one central laboratory in the Capital's state and others in regions in which works are being carried out. Testing methods and standards are specified by the DNER (National Highway Dept).

(2). Material sources are under the MoW responsibility. No crushers or screens are available. Each region has a laboratory and a central one in HQ. British testing standards are used. The average haul distance for material is about 5km and does not cause a problem.

(3). Gravel materials are exploited by respective contractors for minor works and for larger contracts, also contractors have to identify quarries that comply with material specifications. The MoW has a big central materials lab, one materials lab for ministry of water and another at the engineering institutions. Every regional engineers office has a small materials laboratory. British Standards, AASHTO, country specific standards and SADC standards are used. Most area's haulage is about max. of 15km for gravel and 45 km for crushed good aggregates. In the coastal southern area, distances can increase. Good quality material exists on average, but there are a few locations where these materials are out of specification, and stabilisation is employed. Materials at present are free, but since the organisation are moving more towards private ownership, materials will cost.

(2/3). Most materials put on the road are compacted mechanically as per specifications.

#### 7.3.4. Condition Assessment

(1/3). Unpaved roads are inspected systematically each year to determine maintenance requirements.

(2). With respect to the inspection of unpaved roads, guidelines are in place to inspect twice a year but this is not always adhered to. No checks are made of staff carrying out the inspections. The condition assessments are visual.

(1) Checks of staff carrying out inspections are not made with any frequency, the condition assessments are visual.

(3). A consultant is usually engaged to work with staff of the regional engineer in carrying out the surveys. Condition assessments are visual and physical.

#### 7.3.5. Research and Development

(1). Many sources of published research work are available. The organisation sometimes undertakes it's own research.

(2). Published research work is available at MoW HQ. The organisation does not undertake it's own research work.

(3). There are few sources of published research work. Research is normally carried out through consultants and some in-house.

#### 7.3.6. Influence of Overseas Consultants

(1). The organisation developed some manuals and procedures with overseas consultants, in the areas of projects - environment roads guidelines and pavement management etc.

(2). With regard to using manuals or procedures developed by consultants: manuals used for design of minor works and maintenance in the regions. Road notes for maintenance. Assessments of institutional, managerial and technical issues are on going.

(3). The organisation frequently uses TRL manuals. Some practices introduced by consultants have been successful and some not. There was a recent study undertaken by consultants, of the institutional set up of the ministry which has just been completed and is awaiting government action to implement.

## **8. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY U1**

### **8.1. Institutional capability**

#### **8.1.1. Organisation**

The Ministry is divided into 2 directorates. The directorate of engineering, which is responsible for roads is further divided into departments, divisions, sections and district units.

A road agency is envisaged in 3 years time. In the meantime a road agency formation unit is being formed. The policy and monitoring of feeder roads now comes under the MoWTc. A unit from MoLG was moved to MoWTC to centralise the work. The conditional grant is paid by the MoWTC. The MoWTC is in the process of recruiting staff for the formation unit, and a director is now in place.

Emphasis is now on contracting and by 2001, 85% of the work in each district station should be undertaken by contractors, with the remaining 15% being undertaken by force account to cover emergencies.

#### **8.1.2. Administration**

The road maintenance Dept of the MoWTC is only responsible for the classified (major trunk) roads. Other roads (feeder and urban) are the responsibility of local and urban authorities respectively.

A strategic network, or a hierarchy of roads has been established

The district stations near Kampala (Capital) look after about 20% of the gravel roads. District stations in the rural areas look after about 60% of the gravel roads.

#### **8.1.3. Staffing Issues**

A total of about 500 personnel are employed in the engineering directorate and 90% of these are involved in road maintenance. Heads of departments and divisions and also district engineers also make job descriptions for staff under them. There has been a ban on recruitment for approximately 8 months.

#### **8.1.4. Training**

Road maintenance planning and management training for engineers and supervisors. Labourers and lengthmen are given on-the-job training in techniques to execute road maintenance techniques. Engineers and supervisors attend quarterly seminars at the Ministry training Centre. Lengthmen and Labourers are trained in the field regularly. There is naturally some resistance by staff at all levels whenever change is introduced. Some staff are trained to use computer equipment in computer training centres, others are trained in house by experienced staff. It is the intention that all stations should eventually have computers.

#### **8.1.5. Supervisors**

Road maintenance management courses, contract management seminars etc are provided for field supervisors. The field supervisors need to demonstrate a Diploma in Civil Engineering or advanced road overseers course. They supervise approximately 200km of road and about 12 in house staff - foreman and plant operators. They also supervise lengthmen contractors who may total 50 in number. Recently the voluntary retirement of staff and the employment freeze has meant that staff numbers are low, particularly at supervisor and overseer level. The money for salaries is available.

#### **8.1.6. Maintenance Manuals**

Every engineer at district engineer level and above should have copies of the PIARC publications. Road maintenance guidelines are available to every district engineer. A road

maintenance manual produced by the MoWTC is in draft form and it should be completed in about a year.

Standard worksheets and report sheets are used by the District Engineers.

#### 8.1.7. Budget

The preparation/ allocation of maintenance budgets is undertaken by condition, ADT, terrain and other issues such as the importance of the road in the entire network. The priority is to link the districts.

The budget is adequate to achieve accessibility. If the allocation is less than that required, the work scope may have to be scaled down. The MMS used is the Uganda Highway Maintenance management system. Priority is given to maintenance rather than new construction. Each DE provides a programme and there is a ceiling. The ROMAPS system is used for the feeder roads under the ADB project. With regard to prioritisation, the roads connecting districts to the capital must be maintained in a motorable condition throughout the year. The frequency of particular activities depends on the conditions in each district. Money is allocated road by road. Each road is graded at least twice per year, but some more frequently depending on conditions.

#### 8.1.8. Financial Control

The maintenance authority exercises full control of the budget, once it has been awarded, some money is given monthly and some quarterly depending on the programme. The control of the finance is undertaken centrally by the accounting officer (the PS). The budget is split between routine, recurrent and periodic maintenance. An independent auditing procedure is undertaken by the Auditor General and internal audits are undertaken by the Commissioner for maintenance management. Money for maintenance comes from the consolidated fund from the MoF.

### 8.2. Managerial Capability - Inventory (gravel roads)

An inventory for gravel roads exists for the classified roads under MOWTC it was last updated in February 1997. It covers name (link), length, width, drainage, structures, gradient, embankment, height.

The % of the network which is unpaved:

For classified (trunk) roads it is 78%.

For all gazetted roads (classified, feeder, urban) is it 90%

For all roads above but including community roads it is 95%.

#### 8.2.1. Planning and Programming

Road hierarchy is used as a basis for the allocation of resources and maintenance priorities. Work is programmed according to defined priorities such as maintaining a minimum level of service. Consideration is given to long term planning, (3 or 5 year plans) with regard to network enhancement. New roads are built with maintenance in mind. HDM III is available and is used. Traffic count data obtained manually and is up to date, (May 1998). The availability of maps and general road data (construction, historic data etc.) is sketchy. The actual standards and intervention levels achieved with level of skill available is fair to good. Deviation from recommended management practice is usually due to a lack of resources.

#### 8.2.2. Budgeting

The MoWTC specifies the amount of labour, material and equipment that should be used for various tasks. Budget allocations for the different types of maintenance are interchangeable, (between routine and emergency).

The percentage of the budget is taken up by each class of maintenance activity: routine, recurrent, periodic and emergency is approximately:

Routine = 5%    }  
 Recurrent = 50% } = 100% of the whole budget allocation.  
 Emergency = 5% }  
 Periodic = 40%    }

Money is found for emergency works centrally from the maintenance budget, it may mean some maintenance work may have to be dropped if there are many emergencies.

#### 8.2.3. Cost Control

The maintenance engineer inspects and audits the work, because he has to measure and approve works before contractors are paid. He also measures the productivity of staff by measuring output against set targets. If the productivity does not meet the required standards then he has a re-examination of the set targets will be undertaken.

#### 8.2.4. Plant and Equipment

About 200 No of vehicles of different types and makes ranging from supervisory vehicles to large trucks. The machinery is not effectively programmed to avoid over subscription. The workshops and stores are not adequately stocked. Many vehicles break down and some get grounded for over a month due to lack of spare parts and funds.

### 8.3. Technical Capability - Planning

The road maintenance planning procedure is reviewed regularly. There is currently an agreed share of the maintenance obligations between force account units and contracting. Ministry's top management make the decision on which methods should be adopted. Communities are involved in the maintenance of village community roads. The Chairman of the parish may find some money for road maintenance and employ a contractor, or the local people are mobilised. It used to be tradition, but over recent years it is not as common.

All periodic maintenance operations are contracted out. 50% of routine mechanised maintenance operations are contracted. 90% of routine manual maintenance operations are contracted. In general unpaved roads are maintained in a manner which aims to preserve the access for the public.

#### 8.3.1. Contractors

Contractors are still being trained and they are yet to build adequate capacity. They are not well equipped and they do not have enough capital to buy equipment. Training has been curtailed due to inadequate funds. They are available work and eventually a plant hire pool will enable them to hire and repair the equipment currently owned by the MoWTC. Contractors are vetted and a prequalification list which is approved by the central tender board is maintained. Performance bonds are used.

#### 8.3.2. Materials

The material sources are operated by the contractor on contracted works and the Ministry on force account operations. Mainly British test methods are adopted. The average haul distance is 5 km.

#### 8.3.3. Condition Assessment

The district engineer should inspect every road at least once a month. It is systematic. Staff are trained to carry out inspections, and regular checks made of the staff by a trained supervisor or engineer. Condition assessments are mainly visual.

#### 8.3.4. Research and Development

The availability in the country of published research work is limited. Negligible research and development work is being undertaken in the area of construction materials.

#### 8.3.5. Influence of Overseas Consultants

Overseas Road Notes are used. Road maintenance construction specifications together with the road design manual introduced by Roughton International have been quite successful.

## 9. INFORMATION OBTAINED FROM QUESTIONNAIRES - COUNTRY Z2

### 9.1. Institutional Capability

#### 9.1.1. Organisation

The organisation (Dept of Roads) has 8 Provincial road engineers and 107 maintenance units in the provinces. Reforms commenced last year within the organisation.

#### 9.1.2. Administration

The road maintenance department is not responsible for all roads in the area, some are under the district development fund, some under the rural district council. A strategic network, or a hierarchy of roads has been established and has been working but a study has been instituted. Approximately 20% of unpaved roads, in each district are maintained by the organisation

#### 9.1.3. Staffing Issues

The organisation employees about 1500 permanent staff and about 5000 casual workers. There is a clear definition of each person's responsibilities within the chain of command. The responsibilities/ job descriptions are set by the Directorate and Management.

#### 9.1.4. Training

On site training and lectures are received by various levels of staff. The quantity of training received by each is roughly: Technicians - 5 years; Supervisors - depends but can be 2 wks to 6 months over a number of years. There is not too much resistance from staff to changes, the whole country is undergoing reforms. Staff are trained in house and in institutions to use equipment such as computers.

#### 9.1.5. Supervisors

Supervisors are trained at the training centre - covers road construction and maintenance management. Supervisors have to demonstrate qualifications such as: 'O' levels and leadership qualities. They supervise 20 km to about 300km of road and about 25 to 250 staff - normally 25 in maintenance and 250 in rehabilitation and construction.

#### 9.1.6. Maintenance Manuals

In house road maintenance manuals are used, covering: techniques, planning, programming etc. The manuals were developed in house over a long period and they are very well received. Engineers, supervisors and the maintenance construction units 'own' copies of the manuals. The manuals need to include current trends of management. The organisation uses it's own standard forms and worksheets for MMS and for road construction and bridge construction.

#### 9.1.7. Budget

The preparation/ allocation of maintenance budgets is by: Length of road, type of road, condition and ADT. The budget is not enough and covers about 50% of the amount required, therefore prioritisation is carried out (prioritisation follows needs). An MMS based on a Swedish system is used for planning. Maintenance gets a bigger allocation than new construction.

#### 9.1.8. Financial Control

The maintenance authority exercises full control over the budget, once it has been awarded - annually. A politician could not ask for money already allocated to maintenance to be returned for other works, such as new construction or emergency works. The budget is split between routine, recurrent and periodic maintenance. An independent auditing procedure is used - Internal Ministry audit and central government audit. Internal audits are also carried out. Tolls are not used to raise money for maintenance.

## 9.2. Managerial Capability

### 9.2.1. Inventory (gravel roads)

An up to date inventory for gravel roads exists, which covers most items. Approximately 70 - 80% of the network is unpaved.

### 9.2.2. Planning and Programming

Road hierarchy is used as a basis for the allocation of resources and maintenance priorities. Work is programmed according to defined priorities such as: traffic and class of road. Consideration is given to long term planning, with regard to network enhancement, and new roads are built with maintenance in mind. Systems such as HDM-III are available, but are not normally used. Traffic counts are done annually and they are almost always up to date. Maps and general road data are available. The actual standards and intervention levels achieved with level of skill available are good. The reason for deviation from recommended management practice is shortage of funds.

### 9.2.3. Budgeting

The authority specifies the amount of labour, material and equipment that should be used for various tasks. Budget allocations for the different types of maintenance are interchangeable with approval from the directorate. The percentage of the budget taken up by each class of maintenance activity: routine about 35%; periodic about 30%; and approx. 35% for improvements.

### 9.2.4. Cost Control

The maintenance engineer inspects and audits the work and measure the productivity of staff to ensure targets are met. When productivity does not meet the required standards, explanations will need to be given.

### 9.2.5. Plant and Equipment

Approximately 400, lorries and light vehicles, not counting heavy equipment is available. The use of the machinery is programmed to avoid over subscription. About 50% of the workshops/ stores are adequately stocked. The vehicles often break down with repairs generally taking a month or so.

## 9.3. Technical Capability

### 9.3.1. Planning

The road maintenance planning procedure is reviewed as dictated by funding levels and needs from the provinces. The maintenance techniques selected are selected by directorate, with the alternatives being labour intensive techniques. The decision on which methods should be adopted is made by the directorate. Normally, communities have not been encouraged to be involved in the maintenance of roads, but it is intended to do this now. Scope is there for the engineer to use contractors, formal tender procedures are followed, and supervision is quite high. Some use is being made of simple tools to encourage local community maintenance.

### 9.3.2. Contractors

Some lengthmen are used, some contractors supply equipment. The use of contractors is feasible but there are not sufficient contractors in the country, so contractors are being trained. The interests of the client are protected by standards, where payment will not be made if work is unsatisfactory.

### 9.3.3. Materials

Contractors operate the material sources. Materials are normally compacted mechanically. About 9 government and about 4 private laboratories exist in the country. The testing methods are adopted are mainly British or American standards. For about 60% of country haulage distance is 0-10km. For about 30% haulage distance can be as long as 40km.



9.3.4. Condition Assessment

Unpaved roads are inspected systematically to determine the yearly maintenance requirements, not less than five times per year. Staff are trained to carry out inspections, and regular checks made of the staff by a trained supervisor or engineer. Condition assessments are mainly visual.

9.3.5. Research and Development

Availability in the country of published research work is OK. The organisation undertakes its own research and development in the research unit within the department.

9.3.6. Influence of Overseas Consultants

The organisation uses an MMS developed by overseas consultants specifically for use by the organisation. The MMS was partially successful. Two studies have been done on the institutional, managerial and technical capabilities of the organisations prior to implementation of any new techniques



## **10. COMMENTS**

The replies give an overview of the countries, they give some approximate figures, they touch on a number of potentially delicate issues. It should be noted that some of the respondents chose not to answer some of the more delicate questions. The issue which stands out the most is that accessibility is indeed an issue to be addressed, although no information is given on how exactly the issue is addressed in the countries.