BLUE GUIDE – Appendix B1

Guide for the production of Technical Committee reports

Version: Feburary 2013

WORLD ROAD ASSOCIATION
MONDIALE DE LA ROUTE
AIPCR PIARC

CONTENTS

1 INTRODUCTION

The production of Technical Committee reports is one of the most important outcomes of the World Road Association. It is important that the reports are of a high standard both in terms of content, accuracy and appearance.

A Technical Committee report presents the results of investigations on a selected topic. It is based on theories, facts and ideas gathered from Committee members and a variety of other sources.

The reports should provide a succinct reporting of the work of the Committee. They should not contain unnecessary material. They should be easy to read and communicate the results of the Committee's work clearly.

This guide has been produced to assist Technical Committees in the production of their reports and to ensure they are consistent with the requirements of the Association.

2 PURPOSE OF THE REPORT

The Committee needs to make a clear statement about the purpose of the report, including the aims of the work itself. This should be established at the outset of the Committee's work.

A broad outline of the report should be prepared by the working group in charge of drafting the report and submitted to the Technical Committee for approval prior to the commencement of writing the report with a copy sent to the Strategic Theme Coordinator for possible comments. The Chair of the Technical Committee is responsible for the decision of approval.

A development plan for the report should be prepared prior to writing. It should include timeframe, responsibilities, etc.

There should be a statement which relates the aims of the work to the Strategic Plan of the Association and the terms of reference for the Technical Committee. This statement should be included in the introduction of the report. Where appropriate, reference should be made to earlier work of PIARC or others when this outside work forms a basis for the Association work being reported.

3 PRODUCTION AND COMPOSITION OF REPORTS

Regarding the production of reports, a timetable should be set for the various stages of preparation of each report: summary, writing, amendments and revision, approval, translation and production, as well as the allocation of responsibilities for each step.

Although reports can be on a range of topics and of various lengths, the reports should follow the same basic structure. This basic structure is divided into the following parts:

- statement about the Association,
- authors statement,
- table of contents,
- summary,
- introduction,
- body,
- conclusions,
- bibliography / references,
- glossary,
- appendices.

3.1 Statement about the Association

The statement to be used is shown in Appendix B 1.1 to this Guide. It will be introduced by the General Secretariat in the published version of the report. This standard statement about the Association says which organization has produced the report, what is the status of this document and what is the extent of the responsibility of the organization with respect to the content of the report.

3.2 Authors statement

Technical Committee reports are not published under the name of individuals, but as the work of a Technical Committee. Information about who contributed to the production of the report should be a separate section at the beginning of the report and include the following:

- titles of the relevant Technical Committee and working group responsible for the report
- names and countries of origin of the members of the working group who actually contributed to the production of the report (not the list of all Committee members)
- names and countries of origin of the editors of the English and French versions
- names of the translators
- name and country of origin of the person responsible for the quality control of the report
- names and countries of origin of the chair and secretaries of the Technical Committee.

3.3 Table of contents

The table of contents should be displayed in a maximum of 2 sub-section levels.

The final version of the report will enable mouse click navigation from the table of contents to the selected chapter or sub-section when viewing online.

3.4 Summary

Although the summary appears first in a report, it should be written last. The summary contains a summarized version of the entire report, including particularly its purpose, what was done to arrive at the outputs and any conclusions or recommendations, and should not be more than two pages in length.

People who read PIARC reports want to manage their time effectively. They want to ensure that the report is of interest to them before they invest the time and energy to read the entire report. Our audience should know what is in the report from the summary.

3.5 Introduction

It provides a context so that the reader understands what is in the report. It introduces the contents and explains the purpose of the report. The introduction should generally contain the following components:

Purpose – The purpose describes why the report was written, what problem the report was meant to address or the situation that led to the report being produced. It should relate the report to the PIARC Strategic Plan and the terms of reference for the Technical Committee.

Scope – The scope describes the extent and limitations of the report. It tells the reader what specific aspects of the problem will be discussed. Where appropriate it should refer to earlier work of PIARC and others and explain how the report builds on that work.

Methodology – The methodology shows how the information presented in the report was obtained and what procedures were used, e.g. interviews or postal questionnaires. Sometimes an explanation is included of why a particular investigative approach / methodology was chosen.

3.6 Body

The body is the main and most informative part of the report. The value of the entire report is judged by the quality of the information in this section and the clarity with which it is presented.

It should contain all the information and evidence to make a case for solving the problem that the report addresses. It can be subdivided into different topic areas and contains graphs, data, diagrams, charts and tables.

Once all of the information has been gathered, the facts and arguments are presented in an organized and logical manner.

The content covered can include quantitative data outcomes and their analysis, observations, questionnaire outcomes and results of experiments, case studies and any qualitative information.

Present the information in the body in a clear and understandable manner. This involves several steps:

- Break down the information into manageable chunks.
- Use headings and point form to help guide the reader through the information.
- Place visual representations of the information in the appropriate places so the reader understands the main concepts.

The use of numbering should be restricted to 3 levels maximum (e.g. 1.2.1). The fourth level of a sub-section should have no numbering, identification is acceptable using an alpha character if this is absolutely necessary.

3.7 Conclusions

The conclusion clearly relates to the objectives of the work and outlines the main points, arriving at logical outcomes of the material presented. This is the place to draw together key points made in the report. However, nothing new should appear here.

If the report has, for the most part, simply provided information, the conclusions should summarise the major points of the report or offer some general insights.

Reports that are investigative and analytical or make proposals require different types of conclusions. They should contain conclusions that address the problem or situation under investigation.

Conclusions should always be as brief as possible and to the point. If there are a number of conclusions, use a numbered or bulleted list for these points.

3.8 Bibliography / References

PIARC Technical Committee reports should reference all books, articles, journals, websites, and any other sources consulted when writing the publication, using the standardized referencing system described in the **Appendix B 1.1.**

3.9 Glossary

The report will eventually contain a glossary, especially for acronyms and road concepts which are not yet included in the PIARC Dictionary. The glossary has to be produced in English and French. The production of a glossary is very important to help with the translation and for up-grading the PIARC Dictionary and Lexicon.

3.10 Appendices

These should be placed at the end of reports. They should only include relevant information that is too lengthy or detailed to include in the body of the publication. However, attention should also be paid to the length of the appendices. An appendix should only be included if it has direct relevance to the report itself. Voluminous and extraneous material should not be included. Each appendix should contain different information. These should be referred to in the report and not just left to stand alone.

Where the work of the Committee includes a survey using a questionnaire there is no need to include the whole questionnaire as an appendix. The report itself should summarise the results so they are self explanatory.

4 GUIDELINES FOR THE LAY-OUT

4.1 Template

The reports should be prepared using the attached template for the lay-out (Appendix B1.2). This will ease the review and the production of the final version by PIARC General Secretariat.

4.2 Figures

For the production of the final versions of the documents for dissemination on the web and printing, the PIARC Technical Committees are asked to gather together all illustrations (graphs, pictures, photographs) separately from the text itself (on a CD-rom for instance).

All artwork and photographs should be of high definition (min 300 dpi).

4.3 Final version of the reports

The final version of the reports will be produced by PIARC General Secretariat in order to give a consistent presentation to all reports.

An example of the lay-out which will be used by PIARC SG for the coming reports in presented in Appendix B1.3.

5 OTHER CONSIDERATIONS

5.1 Translation

Technical reports are published in separate language versions (English and French). The reports are available in the Virtual Library of the Association's website. **http://www.piarc.org**

The publication of a report delivered in a language does not require waiting for the translation into another language. However, the simultaneous delivery of the two languages is recommended.

For each version, the Technical Committee must validate the translation by a member who is native-speaking in French or English regardless of whether the translation is done within the Technical Committee or outsourced. It should be noted that the PIARC secretariat does not have the technical expertise to ensure the quality of the translation in all fields.

5.2 Electronic and web-based reports

This guide focuses on the preparation of the Technical Committee reports as an electronic file which can be printed.

In some cases, the Technical Committee may consider to produce its work in electronic format for a publication on the Internet or on CD-ROM with links to reference material or with software tools. Where this is envisaged, the format and production of these reports is to be discussed with the PIARC General Secretariat prior to commencement. However, the Technical Committee should present the key points of its work in a report with the same structure as the one described above in order to produce a PDF file.

APPENDIX B1.1

STATEMENTS

The text below is included in each report by PIARC General Secretariat in the final document.

Technical Committees don't have to include it in their draft document.

"*The World Road Association (PIARC) is a non-profit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.*

The study that is the subject of this report was defined in the PIARC Strategic Plan 2004 – 2007 approved by the Council of the World Road Association, whose members are representatives of the member national governments. The members of the Technical Committee responsible for this report were nominated by the member national governments for their special competences.

Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organizations or agencies.

International Standard Book Number xxxxxxxxxxxx (to be added by PIARC SG)

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APPENDIX B1.2

STYLEGUIDE FOR THE PREPARATION OF THE REPORTS BY THE TECHNICAL COMMITTEES

This appendix gives a detailed description of the style sheets to be used by the Technical Committees for the production of a Word Document, in order to obtain consistency between the different documents and to ease the production of the final version.

A template is provided as a separate Word file so that it can be used directly for the preparation of the reports.

The reports must be prepared in black, using the font **ARIAL** (in black)

This guide comprises six sections: Table of Contents, Standard text, Titles, Tables, Illustrations and Bibliography.

TABLE OF CONTENTS

The table of contents is limited to the following levels of titles.

A first level for **Summary, Introduction, Glossary** and **Appendices**.

A second level for the **Chapter titles** designed by : **1.**, **2.**, **3.**, etc.
A third level for the **Subheads 1** designed by: **1.1.**, **1.2.**, **1.3.**, etc.
A fourth level for the **Subheads 2** designed by: **1.1.1.**, **1.1.2.**, **1.1.3.**, etc.

Numbering starts with the Chapter titles (See example in Appendix B 1.3).

Numbering and the **pagination** are in Arab numeral followed by a point: **1.**, **2.**, **3.**, etc.

STYLE SHEET for Summary, Introduction, Glossary and **Appendices**
Example
Introduction 4
Characteristics for TM1: Bold. Font size: **10 pts**. Interline spacing: 12 pts.

STYLE SHEET for Chapter titles
Example
1. WHAT IS ASSET MANAGEMENT? **9**
2. WHY DO WE NEED ASSET MANAGEMENT? **11**
Characteristics for TM2: Capital Letter, Bold. Font size: **10 pts**. Interline spacing: 12 pts.

STYLE SHEET for Subheads 1
Example :
2. WHY DO WE NEED ASSET MANAGEMENT? **11**
2.1. General organizational needs 15
2.2. Needs of key decision-makers 17
Characteristics for TM3: regular. Font size: **10 pts**. Interline spacing: 12 pts.

STYLE SHEET for Subheads 2

Example

Characteristics for TM4: Italic. Font size: **10 pts**. Interline spacing: 12 pts.

STANDARD TEXT

STYLE SHEET for standard text

Characteristics for Standard text: ARIAL. Font size: **10 pts**. Interline spacing: 12 pts.

The body text is fully justified. There is a blank line between two paragraphs.

Distinguish the words **"Figure", "Graphic", "Picture", etc**, from the rest of the text with **bold** letters. Do not use Italic, colour, etc.

STYLE SHEET for lists

Characteristics for Lists: Regular. Font size: **10 pts**. Interline spacing: 12 pts.
One blank line between the text above and the list; Set tab: **0.3 cm**; Bullet point + set tabs: **0.3 cm**

Example :
"…the general components that most jurisdictions employ, implicitly or explicitly, either at a project level or a system level, to determine what work should or can be implemented:

- The objectives, or performance measures are first determined.
- The condition and the capital value of the road network, either on a section or network level…"

TITLES IN THE REPORT

STYLE SHEETS

Summary, Introduction, Glossary, Appendices

Example: **SUMMARY**

Characteristics for TITLE INTRO: Capital Letter. Bold. Font size: **10 pts**. Interline spacing: 12 pts. One blank line between the title and the first paragraph below.

Chapter title

Example: **1. WHAT IS ASSET MANAGEMENT?**

Characteristics for TITLE 1: Capital Letter. Bold. Font size: **10 pts**. Interline spacing: 12 pts. One blank line between the title and the first paragraph below.

Subheads 1

Example: **2.1. General organizational needs**

Characteristics for TITLE 2: Capital Letter. Bold. Font size: **10 pts**. Interline spacing: 12 pts. One blank line between the title and the first paragraph below.

Subheads 2

Example: **2.1.1 Australia**

Characteristics for TITLE 3: Bold. Font size: **10 pts**. Interline spacing: 12 pts. One blank line between the title and the first paragraph below.

Lower titles

Examples: **Austroads (No number)**

Characteristics for TITLE 4: Bold. Font size: **10 pts**. Interline spacing: 12 pts. No numbering. No blank line between the title and the first paragraph below.

TABLES

Font: ARIAL

STYLE SHEET for the titles
Characteristics for TABLE TITLE: Capital Letter. Bold. Centered. Font size: **10 pts**. Interline spacing: 12 pts.

STYLE SHEET for the texts
Characteristics Text TABLE: Regular or Roman Font. Font size: **10 pts**. Interline spacing: 12 pts.

No colour. Width of the black border: **1 pt.**

Example

TITLE	TITLE	TITLE
Text	Text	Text
Text	Text	Text

No size requested for tables. It depends of the content.

ILLUSTRATIONS

When the report is sent to the PIARC General Secretariat for publication, **all illustrations (photographs, images, graphics) must be supplied on a CDROM, separately from the text,** together with the list of the captions**.** A CDROM is preferred since alteration may happen during transmission by e-mail.

Artwork (photographs, images) must be produced with a minimum format of **10x15 cm,** a high definition: **300 dpi**.

When creating a graphic, the maximum size of the original is:

- for a figure in a vertical page, width: **12.5 cm**, height: **18 cm.**
- for a figure in an horizontal page, width: **18 cm**, height: **12.5 cm.**

Within graphics use **ARIAL** font:
Characteristics: Capital Letter. Bold. Font size: **9 pts**. Interline spacing: 12 pts.

For graphs created with Excel, save the graph with its data in order to permit modification in the lay-out.

Whenever possible, in order to create graphics of high quality, use softwares such as Illustrator, In-Design or Photoshop.

BIBLIOGRAPHY / REFERENCES

References to the bibliography should be numbered in increasing order (either the order in which references appear in the text or the alphabetic order of the authors).

The corresponding numbers should be enclosed in [ ].

A bibliographic reference for an article should contain in the following order:

- the surname of the author (in capitals),
- the initials of his/her first name (in capitals),
- the title of the article in its language of publication (enclosed in " "),
- the name of the journal, using international abbreviations,
- the number of the journal,
- paging (beginning and end),
- the date (at least the year).

For a book the bibliographic reference should contain in the following order:

- the surname of the author (in capitals),
- the initials of his/her first name (in capitals),
- the title of the book (inside " ") followed by its subtitle,
- the name of the publisher,
- the place of publication,
- the date (year).

Examples:

[1] BOUSSINESQ, J. "*Application des potentiels à l'étude de l'équilibre et du mouvement des corps élastiques*", Gauthier Villars, Paris, 1885.

[2] PIARC TECHNICAL COMMITTEE ON ROAD BRIDGES
"*Repair of bridges under traffic*", reference 11.03.B, PIARC, Paris, 1991

[3] FAIZ, A. "*An Overview of Automotive Air Pollution*", "*Routes/Roads*", PIARC Magazine, n°274, p.88-92, 1991.

STYLE SHEETS
Characteristics for BIBLIONAME: Numbering and Name in Capital Letter. Font size: **10 pts**. Interline spacing: 12 pts.

Characteristics for BIBLIOTITLE: Title in Italic. Font size: 10 pts. Interline spacing: **12 pts**.

Characteristics for BIBLIOINFO: other information. Regular or Roman Font. Font size: **10 pts**. Interline spacing: 12 pts.

APPENDIX B1.3

EXAMPLE OF FINAL LAY-OUT FOR PIARC TECHNICAL REPORTS

PIARC technical reports will be prepared by PIARC General Secretariat, according to the attached example of lay-out from the material provided by the Technical Committees.

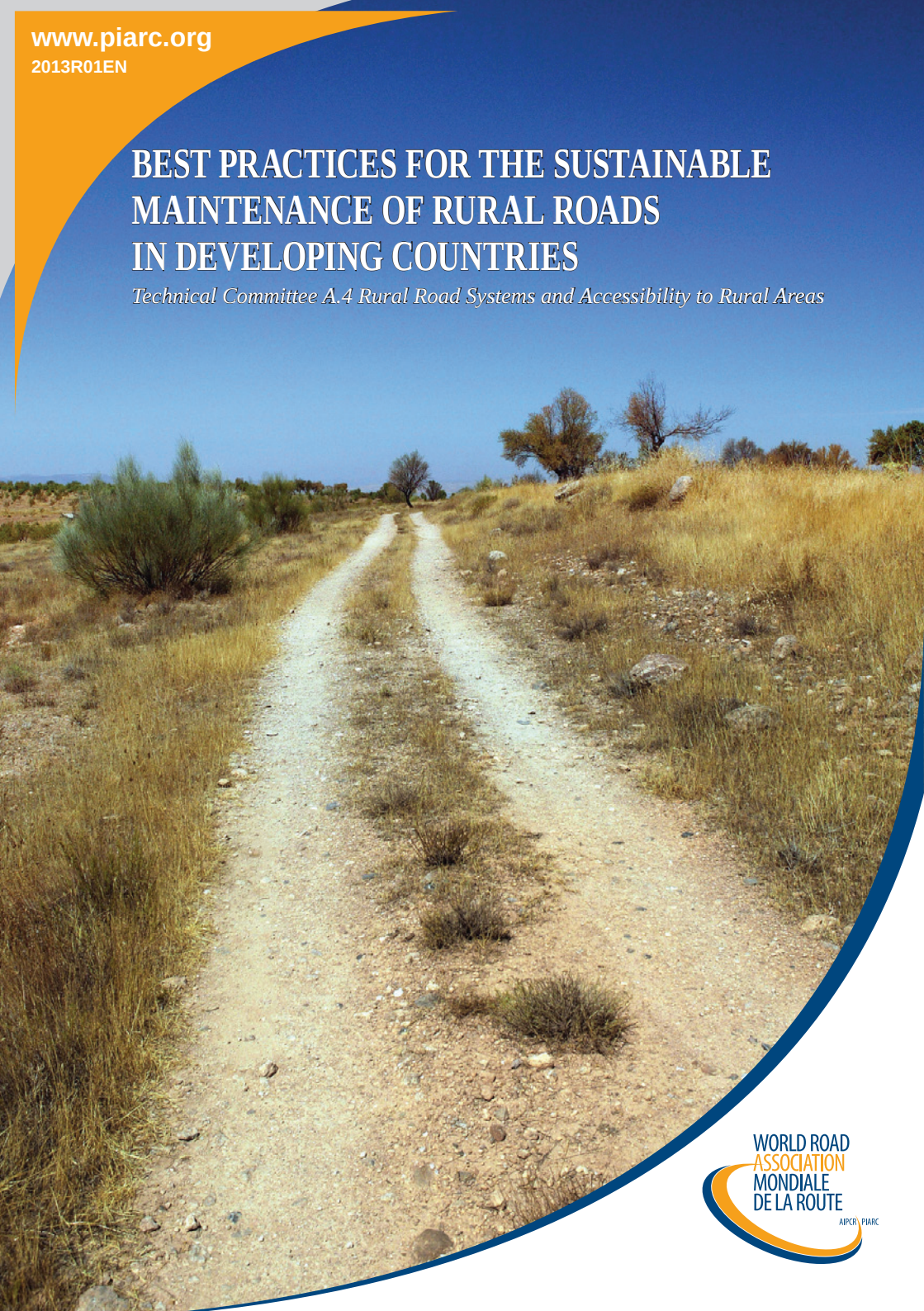
PIARC technical reports will be available from the Internet to be printed in A4 format.

The detailed specifications for the lay-out which will be used by the General Secretariat for on-line publishing and printing of the Technical Reports are defined in a separate internal document.

www.piarc.org
2013R01EN

BEST PRACTICES FOR THE SUSTAINABLE MAINTENANCE OF RURAL ROADS IN DEVELOPING COUNTRIES

Technical Committee A.4 Rural Road Systems and Accessibility to Rural Areas



WORLD ROAD ASSOCIATION
MONDIALE DE LA ROUTE
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STATEMENTS

The World Road Association (PIARC) is a nonprofit organisation established in 1909 to improve international co-operation and to foster progress in the field of roads and road transport.

The study that is the subject of this report was defined in the PIARC Strategic Plan 2007 – 2011 approved by the Council of the World Road Association, whose members are representatives of the member national governments. The members of the Technical Committee responsible for this report were nominated by the member national governments for their special competences.

Any opinions, findings, conclusions and recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of their parent organizations or agencies.

This report is available from the internet site of the World Road Association (PIARC)
http://www.piarc.org

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International Standard Book Number 978-2-84060-309-2

Cover: Fotolia

This report has been prepared by the working group 2 of the Technical Committee A.4 "Rural Road Systems and Accessibility to Rural Areas" of the World Road Association PIARC.

The contributors to the preparation of this report are:

Enrique Leon de la Barra (Mexico);
Manon Baril (Canada);
Alondra Chamorro (Chile);
Maurizio Crispino (Italy);
Prabbah Kant Katare (India).

The main authors of this report are: Manon Baril (Canada), Alondra Chamorro (Chile) and Maurizio Crispino (Italy).

The translation into French of the original version was produced by Canada.

The Technical Committee was chaired by Enrique Leon de la Barra (Mexico). T. Hervé Ouedraogo (Burkina Faso) and Eric Sikam (Papoa-New Guinea) followed by Manon Baril (Canada) were respectively the French and English-speaking secretaries.

The French report is available under the reference 2013R01FR, ISBN: 978-2-84060-310-8.

CONTENTS

EXECUTIVE SUMMARY

Regular maintenance of roads is critical to the economic vitality of a country. In particular, a focus on rural road maintenance is needed when planning and administering a large transport network, as they are often deemed less important than paved roads and highways. When rural roads are neglected, it can cause a detrimental imbalance, with negative effects on the socioeconomic development and political participation of rural populations.

To ensure the funding of rural road projects is done efficiently, a number of steps must be satisfied. First, cost-benefit analyses as well as performance measurements must be defined; costly, unfeasible projects should be rejected. To keep costs low for potential projects, necessary building materials should be available locally and consistent maintenance funding should be established. Also, when simple engineering technology is adequate for rural road development and maintenance, the use of local contractors is suggested, thereby not only lowering costs, but also benefitting the region through job creation as well as giving the rural populace an active role in local development. To guarantee that the rural population receives the maximum benefit from rural road funding, socio-economic criteria should be used to prioritize potential projects, ensuring the greatest number of inhabitants gain year round access to a road system, allowing for comfortable and safe transportation of goods and persons, and contributing to the use of local farmable land.

Due to the lack of political interest, public participation and maintenance culture, many transportation systems around the world are not adequately organized to prevent rural road quality from sliding into a critical state. A new approach to systematic financing and management of rural road maintenance is needed. The policy objective should involve various levels of government and sectors; therefore, coordination and integration is required in order to implement specific financial initiatives directed at long-term rural road maintenance planning. This coordination must also include a consistent and efficient directive lending priority to the redevelopment of existing road infrastructure, strengthening and protecting the rural roads against environmental agents, and ensuring sustained funding for continued maintenance moving forward. Sustained funding, strengthened local-level decision-making, and an integrated approach are essential to establishing a more effective rural road preservation model.

To aid municipalities in developing a long term rural road plan, certain tools are necessary in order for decisions to be made from a socio-economic perspective. Databases and road indicators, for example, allow for an impact analysis of rural roads and their potential to connect marginalized communities with important social services in order to diminish migration to dense urban areas. This information can then be used by the municipality to establish a road priority list specific to the region and with social development in mind, which can then be developed into a long-term road plan at the provincial level.

Rural infrastructure investment and routine maintenance contribute significantly to regional development, rural integration, preservation and reduction of urban demographic pressure. By objectively analyzing socio-economic criteria, rural road rehabilitation can be justified and prioritized. But, in order to sustain rehabilitation, strong leadership is required to organize permanent financing sources, whether through supervised microenterprises or federal endorsements, and to establish locally-influenced, long-term rural road management plans.

1. INTRODUCTION

1.1. BRIEF BACKGROUND

The Technical Committee A.4 *"Rural Road Systems and Accessibility to Rural Areas"* prepared this report titled: *Best Practices for the Sustainable Maintenance of Rural Roads in Developing Countries.* It is based on a literature review, seminars held in India and Bolivia, technical meetings and expertise of the Technical Committee.

1.2. PURPOSE AND OBJECTIVES OF DOCUMENT

The purpose of this report is to provide the users with information on the best practices for sustainable maintenance of rural roads in developing countries with a particular emphasis on Asia, Africa and South America.

Its objectives are as follows:

- to provide a useful tool on best practices of sustainable maintenance to practitioners and organizations;
- to highlight the importance of maintaining rural roads, including their socio-economic benefits;
- to locate various operational methods for maintenance practices;
- to identify maintenance costs and the financing options available; and
- to identify common obstacles and potential solutions for the funding of rural roads in developing countries.

1.3. SCOPE OF DOCUMENT

The report covers a wide range of issues, including:

- analysis of existing planning, financing, and management procedures, thereby identifying best practices;
- identification of common obstacles to proper maintenance of rural roads;
- employment stimulation through the maintenance and reconstruction of rural roads;
- successful experiences allocating funds for the maintenance of rural roads;
- accessibility of rural, poor communities to local markets and social services;
- public and management policies to respond to local mobility and accessibility needs;
- successful experiences using appropriate and innovative technologies for road maintenance, involving local communities; and
- analysis of the tools used for the evaluation of sustainable maintenance.

The expected goal of the report is to present best practices for sustainable maintenance of rural roads; however, the report does not contain detailed technical information on maintenance and rehabilitation practices.

2. IMPORTANCE OF RURAL ROADS MAINTENANCE

2.1. INTRODUCTION

Road deterioration is a staged process; while the initial phase is slow and subtle, it will eventually progress to a critical condition with limited utility if left unmanaged.

Therefore, roads require regular maintenance – with particular attention paid to counteracting deleterious environmental agents – to reach their full potential and lifespan.

It is a known fact that the lack of well-maintained roads generally increases transportation costs; as a result, local and national economies are hampered. Moreover, public and utility services experience difficulty providing for rural communities, particularly in regards to health and education, resulting in an inestimable cost to human development.

In contrast, properly maintained road systems reduce general transportation costs, as well as benefit the country's development. However, because of the budgetary constraints, states are facing it is necessary to adopt fiscally viable technical and financial methods of sustainable road management.

Minor rural roads are usually the last to be accounted for in the transport network. However, rural roads play a crucial role in the economic and social development of societies, linking rural communities to education, health services and markets. As presented in *figure 1, following page*, rural poverty alleviation in developing countries depends on the interaction and simultaneous improvement of rural infrastructure, productive sectors, social and economic services. Ideally, this interaction is supported by an appropriate macroeconomic framework and good governance policies [31].

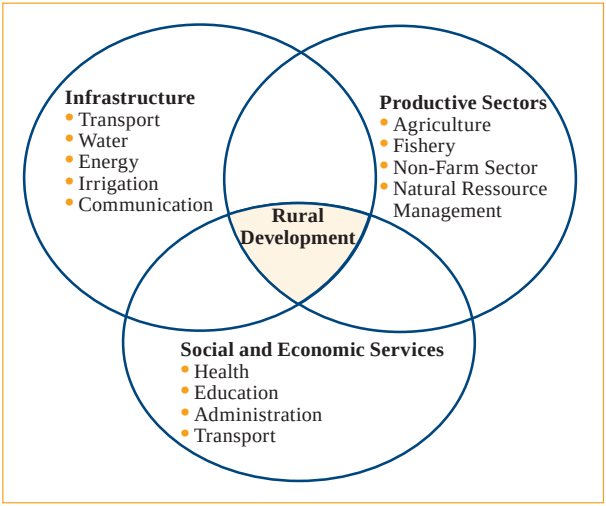

FIGURE 1 – THE ELEMENTS OF RURAL DEVELOPMENT [31]

Rural roads maintenance is therefore critical to ensure adequate access and mobility to rural populations. Agencies in charge of rural roads maintenance have difficulty developing effective engineering solutions to address the functional requirements of all-weather access and selecting low-cost solutions to build and maintain an extensive network. Given the low level of traffic on these roads, it is usually economically unfeasible to pave rural networks, especially in developing countries where budgetary limitations are especially stark.

On technical aspects, some maintenance manuals have been developed by various organizations, which can be adapted by agencies in developing countries. Among these manuals are the following:

- the *"Building Rural Roads"* manual developed by the International Labour Organization [29];
- the *"Gravel Roads Maintenance and Design Manual"* developed by the US Federal Highways Administration under the South Dakota Local Transportation Assistance Program [43];
- the *"Low-Volume Roads Engineering"* guide developed by the US Agency for International Development (USAID) [30]; and
- the *"Low-volume Sealed Roads Guideline"* developed by the Southern African Development Community (SADC) and funded by the UK Department for International Development (DFID), the Norwegian Agency for Development Co-operation (NORAD) and the Swedish International Development Agency (SIDA) [44].

2.2. SOCIO-ECONOMIC IMPORTANCE OF RURAL ROADS MAINTENANCE

2.2.1. Economic Benefits (Evaluation)

One of the fundamental objectives of road maintenance is avoiding the loss of invested capital through the physical protection of the infrastructure and road surface. Maintenance entails avoiding destruction of road structure stretches as well as subsequent rehabilitation or reconstruction.

World Bank studies (1994) point out, based on international evidence, that when a road is neglected, thereby deteriorating to a critical condition, every deferred dollar (US$) in its maintenance increases the traffic operating costs by two or three dollars. If we add the road assets loss expressed in higher restoration or reconstruction costs, it can be concluded that one of the best public investments a country can make is, without a doubt, road maintenance sustainability.

Recent studies have evaluated the positive impact of rural roads investment and development in poor countries. In Asian and African countries, studies have demonstrated a close relationship between the extent of the road network and expenditure on roads with income growth. In India, a study found that expenditure on rural roads presented the most positive impact on rural poverty reduction and income growth. Rural roads investment was shown to be more beneficial to the population than investments in other social and economic sectors [19].

Regarding education and health, studies held in Pakistan [16] and Morocco [32] reveal that the presence of an all-season rural road in a village is associated with higher school enrollment rates, improvement in education quality, higher use of health services, higher immunization levels of the population, and more births assisted by a skilled attendant. Villages with all-season road access have girl school enrolment rates of 41% compared to 27% for those living in villages without all-season road access. In the presence of all-season roads, butane gas is more affordable and, therefore, firewood collection for cooking and heating is less required [38].

In regards to economic growth, it was demonstrated in China that every yuan invested in rural roads resulted in an increase of 5.68 yuan of rural non-farm gross domestic product (GDP) and 1.57 yuan of agricultural GDP [17]. In Vietnam, a positive correlation between the level of economic activity and the extent of the rural road network was observed. It was found that for every dong invested in roads, 3.01 dong of agricultural production value would be produced [18]. A study on a rural Philippine fishing community, previously characterized by poor transport conditions and poor accessibility to major markets, found that the benefits of the road improvement were considerable. Average household income increased from 62,000 pesos/year before the project to 91,000 pesos/year afterwards [35].

In India, it was concluded that public investments in roads was more beneficial to alleviating rural poverty than other kind of public expenses; for every million rupees ($22,000 USD) invested in rural roads, 163 people were able to escape poverty. In Bangladesh, research has shown that some road improvement projects generated a 27% increase in agricultural salaries and 11% in the per capita consumption. Moreover, the rate of moderate and extreme poverty fell between 5% and 7% and there was a rise in education levels for boys and girls.

Regarding household consumption [26], rural road development is a major contributor to household consumption growth in southern China. Similar conclusions were drawn in a study held in Ethiopia, where higher consumption growth was attributed to road quality improvement, especially concerning accessibility during the wet season [15].

Due to the benefits that roads have on social and economic development, it is clear that effective road management not only improves transportation, but also advances core development objectives.

For example, development objectives set for a project in Ecuador aim for the following:

- to promote human development and social and economic incorporation of the rural and indigenous population, offering them permanent access to markets and basic health and education services;
- to enhance decentralization in the country, reinforcing the aptitude for road management of town councils;
- to enhance internal markets, favoring the economic reactivation in agro-ecological areas with a productive potential;
- to promote local development through entrepreneurial capabilities in communities and the maintenance of service payments to micro-enterprises;
- to expand opportunities to access direct, good quality jobs to the unemployed sectors in rural populations, especially among women; and
- to encourage higher social involvement through the development of a participative planning process.

Nonetheless, negative impacts have also been observed in some cases due to poor design and/or management of rural road projects. These include involuntary resettlement, increased traffic accidents and detrimental environmental effects. Therefore, potential negative impacts must be evaluated when considering road infrastructure projects.

2.3. SOCIOECONOMIC INDICATORS AND IMPACT ANALYSIS

The socioeconomic impacts of rural roads can be divided into direct (primary) effects and indirect (secondary) effects. The objective of socioeconomic impact analysis is to assess the magnitude and distribution of both direct and indirect effects. Primary effects are the directly measurable traffic-related effects, like reduced travel times and savings in vehicle operating costs (VOC). The indirect effects of road improvements consist of increases in income and other dimensions of well-being such as health, education, social interaction and political participation. These effects are related to social benefits (secondary effects) and are difficult to measure and isolate from primary effects. Therefore, special attention should be given to avoid double-counting when performing socioeconomic impact analysis [45].

The economic evaluation of rural roads is generally undertaken using a traditional approach, which considers a minimum threshold of economic or Internal Rate of Return (IIRR), Life-Cycle Cost Analysis (LCCA) or Benefit-Cost Analysis (BCA). Benefits accounted by these methods typically consider direct benefits to road users but do not account for indirect effects.

In developed countries, where the economy is less distorted and more competitive, it is expected that direct effects will account for all consequences of road investment. However, in developing countries, while indirect benefits may be obvious to some, they have long been ignored statistically as they are difficult to quantify. As a result, rural road projects are difficult to justify and historically have been given lower priority than they should. For example, a study held in 32 countries in Sub-Saharan Africa showed that on average 60 percent of their road funds are spent on main roads, 18 percent on rural roads and 15 percent on urban roads. While all countries allocate funds to urban roads, 6 of the 32 did not assign funds to rural roads [7].

Several studies have been carried out in developing countries to assess the impact of rural road maintenance projects, including Morocco, Peru, Brazil, Vietnam and Tanzania, in partnership with the World Bank, Asian Development Bank and other organizations. The findings in many cases have been limited due to the lack of available baseline or control data. Overall, it has been difficult to identify the comprehensive benefits achieved from the specific projects. In essence, they focus on just one aspect and they do not effectively integrate findings.

In 2002, the World Bank published a report titled, "*Socioeconomic Impact Assessment of Rural Roads: Methodology and Questionnaires*" [23]. The aim of the study was to develop a comprehensive framework to assist managers with data collection and analytical methods for impact assessments of rural road projects. The study distinguishes several quantitative methods for the evaluation of rural project impacts. Methods are grouped in two major types: Experimental or Randomized Control

Designs and Non-Experimental or Quasi-Experimental Designs. All methods require a clear distinction of the area of analysis, which could be a community, a county, or a district. Commonly, two parallel groups or areas are analyzed: the treatment group, which receives the road intervention and the comparison or control group, which has similar characteristics to the treatment group but does not receive an intervention [6, 39].

The principles and tools proposed by Grootaert were based on past experiences and good practices for the appraisal of socioeconomic impacts. Given the level of detail of the proposed methods, their application is more appropriate for project-level management. Although the framework is very clear and flexible, the approach still requires major technical and financial efforts. In addition, even though the findings are helpful from an economic perspective, no recommendations are made to enhance the management process of rural roads.

The Department for International Development (DFID) and the Transportation Research Laboratory (TRL) in the United Kingdom presented in 2004, *"A Guide to Pro-poor Transport Appraisal: The Inclusion of Social Benefits in the Road Investment Appraisal"*. The document includes a detailed analysis of the problem of socioeconomic impact assessment of rural roads in developing countries. It identifies the nature of social benefits, how they can be measured using indicators, and how they can be included in the appraisal process [45].

In 2005, the World Bank developed the Rural Access Index (RAI), which is a transport indicator that highlights the critical role of access and mobility in reducing poverty in poor countries [40]. The index measures the percentage of the rural population that lives within 2 km of an all-season road, which is equivalent to a walk of 20 to 25 minutes. This indicator is helpful for the assessment of population accessibility at a network management-level and for policy making. In fact, it was used as part of the results measurement system of the 14th round of the International Development Association (IDA-14) for the 81 countries that receive IDA concessionary assistance [38].

3. RURAL ROAD SUSTAINABLE MAINTENANCE PRACTICES

3.1. OPERATIONAL METHODS FOR MAINTENANCE PRACTICES

The guides and manuals from the series, *"Routine road maintenance with micro enterprises"* are specifically oriented to promote routine management of secondary and minor roads based on microenterprises between national or regional governments and municipal administrations responsible for fulfilling that function. These manuals are important due to the increasing decentralization of road management responsibility since the end of the 1990s.

Such are the cases in Colombia and Peru, which apply this methodology widely; Ecuador, Bolivia, Nicaragua and Guatemala, on the other hand, develop local range projects with municipalities.

In these countries, microenterprises have proven to be able to guarantee an optimal transitability level of the roads assigned to them and at lower costs than those generated by traditional maintenance methods.

Not only do routine road maintenance microenterprises help ensure the maintenance of any kind of road to a satisfactory degree, but they also become an important means to enhance local development in rural communities.

This boost is achieved through permanent and quality job generation in microenterprises as well as provisional jobs during the restoring phase, routine maintenance, or road improvement.

Through microenterprise fee payments, economically depressed areas get an important financial boost. In Peru, microenterprises have spurred local consumption and have enabled the production and accumulation of local capital. This significant growth is due to the fact that routine road maintenance enjoys a high profit range.

Between 1984 and 1995, a total of 400 microenterprises were created in Peru. They managed 21,500 km of national and secondary roads, consisting mainly of asphalted roads. This allowed for the generation of 4,900 direct, permanent and good quality jobs. By the end of 1998, 299 microenterprises were operating in Colombia, in which 3,257 people took part as associate-workers, managing 11,679 km of national roads.

Beginning in 1996, this experience was reproduced in Peru by the Rural Roads Program (PCR), a program decentralized from the Communication and Transport Ministry (MTC), which operates with financing from the Peruvian government as well as from the World and Inter-American Banks; the goal being the restoration and routine maintenance of the tertiary national road network. Between 1996 and 2000, 411 microenterprises were created. They oversee 2,800 km of minor roadbed roads (ballasting, dirt roads), which enabled the generation of 4,780 direct and permanent job positions in extreme poverty-striken areas of the country.

Both experiences are considered successful and are still in effect. In 2001, the Peruvian experience has been declared one of the three most successful World Bank projects in the World of that year.

3.1.1. Technical Considerations

With regard to the development of roadbeds, there are two main criteria to be considered when proposing a new rural road development project:

- the technical feasibility or ability to identify the particular importance of sustainability as a desirable goal of transportation policies; and
- the economic justification or the ability to provide a complete picture of the impact on the project's economic and social factors; for example, the associated strategic functions.

All studies confirm the importance of describing all of the economic and social impacts in a cost-benefit analysis.

Other important technical considerations include the following:

- all of the materials required for the road's construction must be available within reasonable distance of the worksite;
- a local authority with available funds must ensure either the construction or the periodical and routine maintenance;
- sociological research into the needs and wishes of the rural residents will help to identify priorities for construction that may have been overlooked by other parties involved; and
- the role of the roads in the creation of jobs and income for workers in rural areas; the needs usually expressed include ensuring school transportation, resurfacing main and secondary roads, and providing a sufficient supply of drinking water to households.

The benefits normally taken into account in economic assessments are as follows:

- direct savings on the running costs of vehicles, the time saved by travellers and the transportation of goods;
- savings in road maintenance costs; and
- broader effects on regional economic development.

The economic and social criteria that may be used to classify road projects in rural areas are as follows:

- current state of accessibility: communities without access, or without access at certain times of the year, will have a higher priority;
- number of inhabitants connected: the higher the number of inhabitants to connect, the greater the priority should be; and
- transportation costs related to road conditions: ensure transportation of goods under the best conditions.

In addition, the cost forecast should be taken into account, as well as the potential environmental impacts. Farmable land area within the influence area must also be considered, which includes an export supply that immediately adjusts to the prices [11] and a domestic supply. Increasing this land area may encourage inhabitants to farm more land in the influenced zone of the road. Unskilled and skilled labour is common to all aspects of agricultural operations.

3.1.2. Labour-Based Work Practices

Labour-based work practices do not exclude the use of equipment. For a comparison, the table below shows equipment most commonly used for the construction of rural roads, using either local labour or conventional methods and heavy-duty roadwork equipment.

Activity	Labour-based method	Equipment-based method
Land clearing	Simple work	Bulldozer or front loader
Excavation	Backhoe	Backhoe, grader
Road drainage	Simple work	Grader
Gravel surfacing	Compactor or backhoe, rolling equipment	Backhoe, grader, rolling equipment, vibrating roller compactor
Bituminous pavement	Compactor, trucks, crusher, asphalt and aggregate spreader	Trucks, crusher, asphalt and aggregate spreader

Most villages have back alleys that are an important part of the transportation system. These alleys are rudimentary and not paved. Projects to make alleys more sustainable using culverts, bridges and retaining walls are generally based on an appropriate combination of skilled and unskilled labour and equipment. In terms of choosing the most appropriate technology for this type of work, it is more important to choose materials that are locally available and, as much as possible, reduce the quantity of materials that have to be brought in from afar.

For road work and civil engineering structures, designs should allow for the work to be done while relying on locally available resources. This applies not only to the choice of materials, but also to the choice of technology. Rural roads mainly consist of simple engineering structures and do not require complex work methods, technology or equipment. For this type of civil engineering work, it is possible to use common engineering technology and to keep things simple. It may be possible to use local builders and contracting companies to carry out the work.

3.1.3. The Microenterprise Model and Contracts

The term '*microenterprise*' is often misused to designate very small businesses (VSBs), but its meaning is, in fact, very limited. Microenterprises are almost

exclusively individual companies, very common in emerging countries where economic development rests almost predominantly on these types of businesses.

Usually, the traditional approach to subcontracting for road maintenance is based on the quantity of work, measured and paid for all working conditions; this is called a *"unit-price contract"*.

Conversely, there are maintenance contracts or performance contracts based on road management performance and on base conditions for the road structure or bridge construction – elements that must be met by the entrepreneur.

Payments are based on the approaches used by the entrepreneur to comply with the performance standards set out in the contract, not on the scope of the work or services delivered. All decisions on the technology applied, the identification and use of materials, the processes, and the management methods are left to the entrepreneur.

The main goal of road management based on maintenance contracts is to preserve road assets in accordance with predefined performance standards over the long term. The challenge is developing performance standards to ensure objectives are reached as efficiently as possible.

In addition, to avoid any ambiguity, performance indicators must be clearly defined and objectively measurable. Rural road improvement policies and strategies must strive to achieve specific results in terms of developing awareness of the role of this approach:

- for system integration and effectiveness and inter-regional and local mobility;
- to ensure development, the protection of the quality of the environment and the preservation of lands;
- to facilitate a reduction of the demographic pressure in urban areas;
- for tourism and jobs; and
- to avoid increased damages due to inclement weather events and climate change.

Performance measurements are the basic input for a variety of decision-making processes and infrastructure management activities.

Many studies [20] have analyzed the value and adequacy of the road system. This evaluation, covering sidewalks, drainage, building line, capacity and cross-section, junctions, bridges, and culverts, was based on annual road system surveys and a series of standards established for various road categories. The data collected was used to produce a number of performance indicators for the condition of the system and trends from year to year. Converted into marks, the indicators were used to determine the level of funding required for capital works and maintenance.

Maintenance includes all of the activities needed to maintain a country's road system. It includes the following:

- routine maintenance (restoration of drainage, filling of potholes and cracks, shoulder maintenance);
- periodic maintenance (resealing, around every 5 years, to renew the surface); and
- rehabilitation (approximately every 15 years, to restore evenness and durability).

TABLE 1 – COSTS FOR GHANA'S ROADS AND SYSTEM LIFE CYCLE

Road class	Network Size (2003)	Routine maint. costs		Asset replacement cost					Periodic maintenance costs					Total maint	Annal life-cycle costs	
Surface type	km	US$/ km/year	US$m/ year	US$/km	years	US$m	US$/ km/year	US$m/ year	US$/km	years	US$m	US$/ km/year	US$m/ year	US$m/ year	US$m/ year	Asset cost
trunk Roads	12,694		13.3			3493.2	275,185	137.6			425.1	4,865	61.8	75.0	212.7	6.1%
Asphalt	1,604	1,147	1.8	500,000	30	801.9	499,938	26.7	110,000	12	176.4	9,167	14.7	16.5	43.3	5.4%
Bituminous	4,733	1,043	4.9	300,000	30	1,419.9	300,000	47.3	23,000	9	108.9	2,556	12.1	17.0	64.4	4.5%
Gravel	6,357	1,022	6.5	200,000	20	1,271.4	200,000	63.6	22,000	4	139.9	5,500	35.0	41.5	105.0	8.3%
Urban Roads	4,064		7.3			796.2	195,915	31.3			107.2	3,746	15.2	22.5	53.8	6.8%
Asphalt	413	1,907	0.8	404,422	30	167.0	404,358	5.6	83,555	12	34.5	6,963	2.9	3.7	9.2	5.5%
Bituminous	1,522	1,907	2.9	227,342	30	346.0	227,332	11.5	27,580	9	42.0	3,064	4.7	7.6	19.1	5.5%
Gravel	2,129	1,700	3.6	133,020	20	283.2	133,020	14.2	14,436	4	30.7	3,609	7.7	11.3	25.5	9.0%
Feeder Roads	32,611		13.0			872.8	26,764	43.5			149.1	1,190	38.8	51.8	95.4	10.9%
Bituminous	1,214	470	0.6	141,333	30	171.6	141,351	5.7	16,224	9	19.7	1,803	2.2	2.8	8.5	4.9%
Gravel	17,766	470	8.4	30,000	20	533.0	30,000	26.6	6,324	4	112.4	1,581	28.1	36.4	63.1	11.8%
Earth	13,630	300	4.1	12,336	15	168.1	12,333	11.2	1,250	2	17.0	625	8.5	12.6	23.8	14.2%
Total	49,369		33.6			5,162.2	104,564	212.5			425.1	9,800	115.8	149.4	361.8	7.0%
Adm costs			1.7					10.6					5.8	7.5	18.1	
Grand total			35.3			5,162.2		223.1			425.1	9,800	121.6	156.8	379.9	7.4%