Development of Pavement and Geometric Design Standards for Low Volume Roads (Rural and Urban) In Zambia

Final Inception Report

Authors: M I Pinard, J Rolt, J Hongve, S Rattray, H Ribbens, D Garner, E Mukandila

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Cover Photo: Authors

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ReCAP Project Management Unit  
Cardno Emerging Market (UK) Ltd  
Oxford House, Oxford Road  
Thame  
OX9 2AH  
United Kingdom
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Low volume roads, pavement design, geometric design, urban roads, rural roads.

**RESEARCH FOR COMMUNITY ACCESS PARTNERSHIP (ReCAP)**
*Safe and sustainable transport for rural communities*

ReCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa and Asia. ReCAP comprises the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). These partnerships support knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The ReCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

See [www.afcap.org](http://www.afcap.org)
# Acronyms, Units and Currencies

<table>
<thead>
<tr>
<th>Acronym</th>
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<tr>
<td>AADT</td>
<td>Annual Average Daily Traffic</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
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<td>AfCAP</td>
<td>Africa Community Access Partnership</td>
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<td>ARRB</td>
<td>Australian Road Research Board</td>
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<td>CSD</td>
<td>Context-Sensitive Design</td>
</tr>
<tr>
<td>CSS</td>
<td>Context-Sensitive Solution</td>
</tr>
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<td>Department for International Development</td>
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<td>Desktop Publishing</td>
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<td>Environmentally-Optimised Design</td>
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<td>IR</td>
<td>Inception Report</td>
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<td>Low Volume Road</td>
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<tr>
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<td>Southern Africa Transport and Communications Commission</td>
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</tr>
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<td>Table of Contents</td>
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<td>Transport Research Laboratory</td>
</tr>
<tr>
<td>TSC</td>
<td>Technical Steering Committee</td>
</tr>
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<td>UK</td>
<td>United Kingdom (of Great Britain and Northern Ireland)</td>
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Executive Summary

The ReCAP-supported project for the Development of Pavement and Geometric Design Standards for Low Volume Roads (Rural and Urban) in Zambia is being undertaken in five stages. Stages 1 and 2, the Kick-off Meeting and the Recruitment of the Expert Team respectively, have already been completed. Following the holding of the Inception Workshop, all activities under Stage 3 have also been completed with the submission of this Final Inception Report. Stage 4 of the project will include the preparation of the 1st Draft Manuals followed by a peer review process on which basis the manuals will be updated and submitted to the client for final review and approval. The final Stage 5 of the project will include Desktop Publishing and printing of the finally approved manuals, followed by a launch event.

The initial literature review has revealed that the information required to populate the Table of Contents for the Pavement Design Manual is available largely from a number of previously compiled low volume road (LVR) manuals developed under ReCAP. However, this is not the case with the pavement or geometric design of low volume urban roads which have been included for the first time in LVR manuals being developed under ReCAP. This has necessitated the undertaking of an extensive review of other manuals produced in the region, particularly in South Africa, and internationally.

The development of the Pavement Design Manual will follow the approach adopted for similar manuals produced previously under ReCAP. However, because of the different approach required for the development of the Geometric Design Manual for rural and urban roads, it is proposed to divide this manual into two parts, namely: Part A: Rural Roads, and Part B: Urban Roads (Streets).

The outline Table of Contents included previously in the Draft Inception Report was generally agreed at the Inception Workshop, but with the addition of chapters on Hydrology & Drainage Structures and Life-Cycle Costing.
1 Introduction

1.1 Background
Currently, there are no local guidelines or manuals specific to the design of low volume rural and urban roads in Zambia. This has led to a need to develop new manuals for pavement and geometric design to ensure uniformity of standards in the provision of low volume roads (LVRs) in rural and urban areas of the country. These manuals are required to take account of the significant developments that have taken place in various aspects of LVR technology in the past few decades largely under the UK Department for International Development (DFID)-supported Africa Community Access Partnership (AfCAP) and the South East Asia Community Access Partnership (SEACAP).

1.2 Scope of Project
The project is being carried out in five stages with related activities as indicated below:

Stage 1: Kick-off meeting
1.1: Hold kick-off meeting
1.2: Prepare Record of Meeting

Stage 2: Recruit Expert Team
2.1: Initiate recruitment process
2.2: Evaluate candidate submissions
2.3: Prepare and submit Team Selection Report

Stage 3: Inception Stage
3.1: Hold 1-day Mobilisation meeting
3.2: Prepare Mobilisation Meeting Report
3.3: Undertake Literature Review
3.4: Prepare Draft Inception Report
3.5: Hold 1-day Inception Workshop
3.6: Prepare Final Inception Report

Stage 4: Prepare Manuals
4.1: Prepare 1st Draft Manuals
4.2: Hold 2-day Manuals Review Workshop
4.3: Prepare Workshop Report
4.4: Prepare 2nd Draft Manuals
4.5: Send manuals for peer review
4.6: Prepare final manuals

Stage 5: Produce and Launch Manuals
5.1: Undertake Desk Top Publishing of manuals
5.2: Undertake printing of manuals
5.3: Prepare USBs of manuals
5.4: Submit manuals and USBs to client
5.5: Launch manuals (half day)
5.6: Prepare Launch Report

Stages 1 and 2 have already been completed and, following the holding of the Inception Workshop and the submission of this Final Inception Report, Stage 3, the Inception Phase, has also been completed.
1.3 Purpose of Report
Against the above background, the purpose of the Final Inception Report is to summarise the key activities undertaken up to Stage 3 of the project, including agreements reached at the Inception Workshop on the outline Table of Contents for the manuals. To this end, the report is structured as follows:

Section 1: (this section): provides the background to the project including the key stages of its execution.

Section 2: Provides an overview of the preparatory stages of the project.

Section 3: Outlines the approach and methodology for carrying out the remainder of the project.

Section 4: Presents the programme and project team inputs for undertaking the project.

Section 5: Describes the approach to undertaking the initial literature review and includes the agreed outline Table of Contents of the manuals.

Section 6: Summarizes the main outcomes of the project to the end of Stage 3 of its completion.

Annex A – Lists the various references reviewed in preparing the Table of Contents of the manuals.
2 Preparatory Activities

2.1 General

The preparatory activities that precede the current stage of work, i.e. Stages 1.1 to 3.3 as listed in Section 1.2, have included the following:

- Kick-off Meeting
- Recruitment of expert team
- Aspects of the Inception Stage (Activities 3.1 and 3.2)

The main outcomes of the above activities are summarised below:

2.2 Kick-off Meeting

The Kick-off Meeting was held on 1st September, 2017 at the RDA headquarters in Lusaka and was attended by the Client (RDA), the ReCAP Regional Technical Manager (East and Southern Africa) and the Consultant’s Project Director.

The main objective of the meeting was to kick-start the project officially. The key items discussed included:

- Project Overview
- Procurement of Project Team
- Intended start date of project

A record of the Kick-off Meeting was submitted to the Client on 3rd September, 2017. The outcome of the meeting may be summarized as follows:

- Currently there are no local guidelines specific to the design of low volume rural and urban roads in Zambia.
- The objective of the project is to develop manuals for pavement and geometric design standards to ensure uniformity in the design of LVRs in rural and urban areas in Zambia.
- The Terms of Reference (ToR) emphasize the need to ensure that the manuals provide *simple and easily applied methods* for determining appropriate pavement structures for the types of LVRs envisaged in both rural and urban environments in Zambia.
- The contract was signed on 15th August, 2017 and the project commencement date was 1st September, 2017 with an anticipated completion date of 20th July, 2018.
- The procurement of the project team was to commence immediately after the Kick-off meeting with the objective of recruiting high caliber experts to fill the various key positions on the team.
- A Technical Steering Committee comprising representatives of key stakeholder organisations would be established by RDA and particulars forwarded to ReCAP and the Consultant for information/comment.
2.3 Recruitment of Project Team

The procurement method stipulated in the ToR for the project placed the responsibility for recruiting the project team on the appointed Project Director. Accordingly, the Request for Proposals (RFP), which was issued on 5th September 2017, with a closing date indicated of 29th September 2017, was disseminated widely on social media platforms/websites hosted by a number of ReCAP partner organisations.

Based on the response to the RFP, a Team Selection Report was prepared and submitted to the Client on 11th October, 2017. Following a prolonged period of discussion amongst the parties to the project, the following project team was eventually selected:

- Team Leader: M I Pinard (Infra Africa (Pty) Ltd, Botswana)
- Pavement Design: J Hongve (Independent Consultant, Norway) (pavement design aspects)
  - S Rattray (Rankin Engineering, Zambia) (materials aspects)
- Geometric Design: J Rolt (Independent Consultant, UK)
- Ad Hoc specialist – Urban Pavement Design: E Mukandila
- Ad hoc specialist – Urban Geometric Design: D Garner
- Ad hoc specialist – Road safety: H Ribbens

2.4 Mobilization Meeting

A Mobilization meeting was held on 18th April, 2018 at the RDA headquarters in Lusaka and was attended by the Client (RDA), the ReCAP Regional Technical Manager (East and Southern Africa) and the Consultant’s project team.

The main objective of the meeting was to review, update and discuss issues related to the implementation of the project, following the appointment of the project team. The key items discussed included:

- Introduction of the project team
- Overall scope of the project
- Approach and methodology for undertaking the project
- Programme
- Project management

The following is a summary of the key issues that were discussed and agreed following the Consultant’s overview presentation on the project:

- Of the three classes of roads defined in the Public Roads Act No. 12 of 2002, namely: Primary, Secondary and Tertiary, the focus of the manuals will be on the Tertiary roads.
- The scope of the manuals will focus on topics normally included in such documents. This would exclude such topics as hydrology and bridge/major drainage structures, maintenance operations/procedures, construction issues such as borrow pit management, technical auditing, etc.
- A proposed Table of Contents will be included in the Draft Inception Report based on the outcome of the initial Literature Review.
- Members of the Technical Steering Committee will participate in the Inception Workshop which, it was agreed, would be targeted for the week beginning 25 June, 2018 (the Consultant to advise RDA formally of this proposed date).

- The RDA will provide the Consultants with the following information:
  o A copy of the Public Roads Act
  o Copies of the 1994 SATCC Pavement and Geometric Design Standards which are currently used as the national standards in Zambia.
  o Local Authority guidelines related to urban geometric design standards
  o Typical Vehicle Equivalence Factors (VEFs) used for determining design traffic loading.

By kind courtesy of the RDA, a site visit was made to typical low volume rural and urban roads within the outskirts of Lusaka. Brief observations arising from these visits were presented in the Mobilisation Report.
3 Approach and Methodology

3.1 General

The approach and methodology for carrying out the project is detailed in the Consultant’s Technical Proposal that was approved by ReCAP and the RDA. This information has also been presented and discussed at the Kick-off and Mobilization meetings. Thus, outline details only of the approach and methodology for the remaining stages of the project are presented below.

3.2 Stage 3 – Inception Phase

3.2.1 Objectives

The objectives of the Inception Phase of the project are two-fold, viz:

(1) To review the LVR manuals prepared for Tanzania, Mozambique, Kenya and Ethiopia with AfCAP support in 2016, as well as other relevant documentation from Zambia and from other organisations, such as TRL and SATCC.

(2) To hold a 1-day Inception Phase Workshop with the RDA and the Technical Steering Committee (TSC) at which the Draft Inception Report will be presented, including the proposed Table of Contents for both the pavement and geometric design manuals. In addition, to discuss any issues related to the approach and methodology for undertaking the remainder of the project.

3.2.2 Approach and methodology (inputs)

In order to achieve the above objectives, the core members of the project team will:

(1) Undertake an extensive literature review of LVR manuals prepared under AfCAP as well as by other relevant organisations.

(2) Prepare a Draft Inception Report including the outcome of the literature review and a proposed ToC for both the pavement and geometric design manuals.

(3) Participate in a 1-day Inception Phase Workshop at which the Consultant will:

   a. Provide an update on the activities undertaken since the commencement of the project;
   b. Present their outline approach for undertaking the remaining stages of the project;
   c. Present their proposed Table of Contents for the new manuals for discussion and agreement with the RDA/TSC.

Based on the outcome and feedback from the workshop, a Final Inception Report will be produced, including an agreed Table of Contents, which will be used for drafting the manuals.

3.2.3 Outputs

The outputs of Stage 3 of the project will be as follows:

(1) An Inception Phase Workshop including agreement on the proposed Table of Contents for the manuals.

(2) A final Inception Report that will include the following:

   a. The preparatory activities undertaken since the commencement of the project
   b. A detailed methodology and programme for undertaking the project.
c. The proposed time inputs for the core team of experts as well as for the ad hoc experts.
d. The outputs of the literature survey.
e. The proposed Table of Contents of the two manuals.

3.3 Stage 4 – Preparation of Manuals

3.3.1 Objectives

The main objectives of Stage 4 of the project are to prepare the draft manuals that will then be finalized after presentation and discussion at a 2-day Manuals Review Workshop of the 1st Draft Manual, as well as on the basis of comments made by the peer reviewers on the final 2nd Draft Manuals.

3.3.2 Approach and Methodology

In order to achieve the above objectives, the entire project team (core plus ad hoc members), will be involved in drafting the manuals based on the outcome of the literature review undertaken during the literature phase and the format, structure and content of the new manuals agreed with the RDA during the Inception Phase of the project.

The 1st draft of the manuals will then be presented at the 2-day Manuals Review Workshop at which it is expected that the full complement of the TSC will be present and will subsequently provide their written comments. Their comments will be incorporated in the 2nd Draft manuals which will then be subjected to an external peer review process. Any comments from this process will then be taken into account in preparing the final manuals which will then be submitted to the client for final review and approval. Once finally approved, the manuals will be subjected to Desk Top Publishing (DTP) and printing.

3.3.3 Outputs

The final output of Stage 4 will be the approved Pavement Design Manual and Geometric Design Manual based on the preceding developmental stages involving TSC and peer review of the 1st and 2nd Draft manuals respectively.

3.4 Stage 5 – Production and Launching of Manuals

3.4.1 Objectives

The objectives of the final stage of the project are to:

1. Finalise the manuals based on the peer review comments on the 2nd draft manual, their incorporation in the final manual and final review and approval by the client.
2. Undertake DTP of the final manuals and obtain final approval from the client for their printing.
3. Print 200 copies of each of the final manuals and produce 200 USBs of each manual.
4. Launch the manuals at a half-day event.

3.4.2 Approach and methodology

Upon completion of the manuals (Stage 4), they will be proof-read by the project team and finalized by the Team Leader. The final product will then be sent to a DTP specialist for final layout. Thereafter, the print-ready DTP documents will be submitted to the client and sent for final review, and approval after which they will be printed in full colour and with “perfect” spine binding.
Upon completion of the 200 printed copies of each manual and production of the requisite edition of 200 USBs of each manual, the Team Leader will participate in the launching of the manuals for which a PowerPoint presentation of the key features of the manual will be prepared and presented and a launch report furnished subsequently.

3.4.3 Outputs
The outputs of the final stage of the project will include:

(1) The production of Pavement and Geometric Design Manuals for Low Volume Roads (Rural and Urban) in Zambia
(2) The production of 400 No. USBs (200 for each manual) for the RDA
(3) The launching of the new manuals at a half-day workshop.
4 Programme and Project Team Inputs

4.1 General

Figure 1 on the following page presents the detailed Work Programme for undertaking the project. This programme indicates the following:

- The timing, sequence and duration of the proposed tasks, taking into account travel time, including the number of personnel days proposed by activity.
- The identification and timing of major milestones (including deliverables) in executing the contract, including an indication of how they will be achieved in accordance with the requirements stipulated in the Terms of Reference.
- The deliverables against which payments will be made.

4.2 Project Time Inputs

The indicative number of working days and breakdown of time inputs by project stage for each member of the project team is presented in Table 1 below.

<table>
<thead>
<tr>
<th>Expert Team Positions</th>
<th>Number of days by stage</th>
<th>% Total</th>
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<tr>
<td>Team Leader</td>
<td>1.5</td>
<td>5.0</td>
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<tr>
<td>Lead Author (Pav Design) + Assistant Author Materials</td>
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<tr>
<td>Lead Author (Geo Design)</td>
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<tr>
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<td>0</td>
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<tr>
<td>Specialist (Road Safety)</td>
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<td>0</td>
</tr>
<tr>
<td>Project Management</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>2.2</td>
<td>5.7</td>
</tr>
<tr>
<td>% by stage</td>
<td>1.5</td>
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</table>
### Stage 1: Project kick-off
- Kick-off meeting
- Prepare record of meeting

### Stage 2: Recruitment of Expert Team
- Initiate recruitment via external organisation
- Evaluate candidate submissions
- Prepare Team Selection Report
- Client review and approval of Report

### Stage 3: Inception
- Mobilisation meeting
- Literature Review
- Prepare Draft Inception Report
- Inception Workshop
- Team/TSC meeting plus field visit
- Final Inception Report

### Stage 4: Preparation of Manuals
- 1st Draft Manuals Write-up
- Manual Review Workshop
- Team/TSC meeting
- Manual Review Workshop Report
- Preparation of Final Draft Manuals
- Peer Review of Final Draft Manuals
- Incorporation of Peer Review comments

### Stage 5: Produce and Launch Manuals
- DTP
- Printing
- USBs
- Submission of Hard Copies and USBs
- Preparation of launch
- Official launch/handover of manuals
- Preparation of Official Launch Report

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**Figure 1 - Revised Work Programme**

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</table>

- **Stage 1: Project kick-off**
- **Stage 2: Recruitment of Expert Team**
- **Stage 3: Inception**
- **Stage 4: Preparation of Manuals**
- **Stage 5: Produce and Launch Manuals**

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**Development of Design Standards for Low Volume Roads in Zambia –Inception Report**

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**Subtotal**

- Project Management
- Total days
- Grand total days

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**Milestones**

- Meetings/Workshops
- Reports (not Milestones)

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5 Literature Review

5.1 General

The Terms of Reference indicate the need to at least include the following documents as part of the literature review:

- LVR design manuals prepared for Tanzania, Mozambique, Kenya and Ethiopia with AfCAP support in 2016.
- Relevant UK Transport Research Laboratory’s Overseas Road Notes
- SATCC design standards

However, it should be appreciated that, in principle, the literature review would be undertaken in response to perceived gaps in an idealised table of contents (ToC) for the design manuals. Thus, the approach adopted in undertaking the initial literature review was as follows:

- Consider the contents of the manuals included in Section 3.5 of the Terms of Reference.
- Develop an idealised ToC based on prior experience of developing similar manuals but customised to the Zambian environment.
- Undertake a literature review to fill any gaps in information required to satisfy the contents of the ToC.

One crucially important point that should be mentioned at the outset is that the Zambia manuals include both rural and urban roads. The latter category of roads has not been addressed in any previous AfCAP manuals, or indeed, by any of the documents listed in the ToR. Thus, a key requirement of the literature review required looking well outside of the normal sources of information on LVRs that tend to focus primarily on rural roads. Ultimately, the aim is to provide Zambia with comprehensive state-of-the-art Design Manuals for Pavement and Geometric Design covering both low-volume rural and urban areas.

Notwithstanding the above, in developing an idealised ToC for the manuals, cognisance needed to be taken of the many, relatively recent developments in LVR technology that are summarised below.

5.2 Developments in Low Volume Roads Technology

The manuals will need to take account of the significant developments that have taken place in various aspects of LVR technology in the past few decades. These developments are based, in large part, on UK DFID-supported LVR research and investigations carried out in Asia and Africa under the SEACAP and AfCAP programmes respectively. The outputs of these programmes have not only questioned many of the accepted approaches to the provision of LVRs but have also shown quite clearly the need to revise them in line with new developments. This has led to an increasing move away from the conservative, and often inappropriate, approaches of the past to more progressive approaches informed by research and performance-based evidence, including the development/recognition, amongst others, of the following:
5.2.1 General

- An environmentally optimised design (EOD) approach to the provision of LVRs that is task-based and appropriate to the local road environment in terms of a variety of impacting factors such as rainfall, available materials, construction capacity, etc., in the most cost-effective and sustainable manner.

- A need for the adoption of optimized standards for the various LVR classes that are “fit-for-purpose” and are affordable to enable the Government of Zambia to expand and maintain the LVR network.

- The likely impact of climate-related events specific to the road environment with due consideration to the adoption of appropriate climate-adaptive countermeasures.

5.2.2 Pavement design

- The use of simplified, but relatively robust, methods of pavement design with the objective of providing a range of cost-effective pavement solutions that are appropriate to the local road environment.

- The selection of locally available construction materials based on the use of performance-based specifications and appropriate methods of testing that have widened the scope for incorporating a wider range of such materials in LVR pavements.

- An increased focus on the provision of appropriate pavement side drainage, cross-drainage and final road level design in relation to the drain invert level (drainage factor) to ensure that the pavement operates in as dry a state as possible.

- The use of surfacing types that can be constructed using labour-based construction methods.

- The use of enhanced levels of compaction to maximise pavement layer stiffness, minimise pavement layer deflections and reduce material permeability, coupled with improved but simplified methods for compaction quality control.

5.2.3 Geometric design

- Recognition that the approach to the geometric design of rural and urban roads is quite different in that the former is based largely on traffic volumes (AADT) whereas the latter is based primarily on a functional road/street classification approach.

- Adoption of a multidisciplinary approach, generally referred to either as context sensitive design (CSD) or context sensitive solutions (CSS) – this recognises that exceptions may be required in some cases in applying standards. For example, where provision of an engineered alignment results in excessive earthworks, it may be preferable to lower the design speed.

- A move to a human factors-based philosophy of design which is predicated on driver characteristics/capabilities and not primarily on the capabilities of the design vehicle and the laws of physics.

- Design Domain concept – being the range of values deviating from the norm that may be adopted under specific circumstances for any particular geometric design standard.
• Adoption of more appropriate geometric cross-section elements, including road widths, to cater for variable travelling speeds in rural areas as dictated by traffic volumes (AADT), local vehicle characteristics and prevailing topography.

5.2.4 Road safety
• A need to cater for a significant amount of non-motorized traffic, especially in urban/peri-urban areas, coupled with a focus on the adoption of a range of low-cost road safety measures.
• The principle of “Sustainable Road Safety” in urban environments including the systematic application of various key safety principles such as functional, homogeneous and predictable use of the urban road network.
• The emergence of the “Complete Streets Concept” which focuses on providing for the safe mobility of all road users in urban and rural areas, not just for those using motor vehicles.

Careful consideration of the above developments in LVR technology, amongst others, has featured prominently in the development of the proposed ToC for the manuals.

5.3 Proposed Table of Contents

5.3.1 Pavement Design
Based on consideration of the contents of the pavement design listed in Section 5.3 of the ToR, as well as on the Consultant’s experience of developing similar manuals in the African and Asian region and following discussions with the Technical Steering Committee at the Inception Workshop held on Tuesday 26 June, 2018, the agreed outline ToC for the Pavement Design Manual is as follows.

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13 CLIMATE CHANGE ADAPTATION
12.1 Introduction
12.2 Climate Resilient Infrastructure

5.3.2 Literature Review - Pavement Design
As mentioned previously, there are no design guidelines specifically related to LVRs in Zambia. The main document currently used – “Recommendations on the Road Design Standards: Pavement Design” (1994) is essentially the same as the AASHTO-based SATCC design guide which applies to high volume trunk roads.

The information required to populate the ToC for the Pavement Design Manual is largely available from a number of previously compiled LVR manuals for rural roads. However, this is not the case for urban LVRs for which recourse was made to a number of other manuals as listed in Annex A.

5.3.3 Geometric Design
Because of the different approach to the geometric design of rural as against urban roads, it is proposed to divide the Geometric Design Manual into two parts, namely: Part A: Rural Roads and, Part B: Urban Roads (Streets). In accordance with this proposal and based on consideration of the contents of the geometric design manual listed in Section 5.3 of the ToR, as well as on the Consultant’s experience of developing similar manuals in the African region and following discussions with the Technical Steering Committee at the Inception Workshop held on Tuesday 26 June, 2018, the proposed outline ToC for the Geometric Design Manual is as follows.
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6.8 Medians and Outer Separators
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8. INTERSECTIONS
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8.2 Intersection Sight Distance
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8.5 Intersection Spacing
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8.9 Intersection Related Aspects
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- Road hump and rumble strips
- Cul de sac details
- Drainage details
- Mini circle details
- Pedestrian crossing details
- Typical intersection layouts
- Typical services layouts/cross sections.

5.3.4 Literature Review – Geometric Design

The main focus of the literature review for the geometric design manual was with regard to urban roads. The information required to populate the ToC for the Geometric Design Manual required extensive review of other manuals produced in the region, particularly South Africa and internationally, e.g. Australia. The list of references reviewed is presented in Annex A.
6 Summary

6.1 Overall Summary

The ReCAP-supported project for the Development of Pavement and Geometric Design Standards for Low Volume Roads (Rural and Urban) in Zambia is being undertaken in five stages. Stages 1 and 2, the Kick-off Meeting and the Recruitment of the Expert Team respectively, have already been completed. Following the holding of the Inception Workshop, all activities under Stage 3 have also been completed with the submission of this Final Inception Report. Stage 4 of the project will include the preparation of the 1st Draft Manuals followed by a peer review process on which basis the manuals will be updated and submitted to the client for final review and approval. The final Stage 5 of the project will include Desktop Publishing and printing of the finally approved manuals, followed by a launch event.

The initial literature review has revealed that the information required to populate the Table of Contents for the Pavement Design Manual is available largely from a number of previously compiled low volume road (LVR) manuals developed under ReCAP. However, this is not the case with the pavement or geometric design of low volume urban roads which have been included for the first time in LVR manuals being developed under ReCAP. This has necessitated the undertaking of an extensive review of other manuals produced in the region, particularly in South Africa, and internationally.

The development of the Pavement Design Manual will follow the approach adopted for similar manuals produced previously under ReCAP. However, because of the different approach required for the development of the Geometric Design Manual for rural and urban roads, it is proposed to divide this manual into two parts, namely: Part A: Rural Roads, and Part B: Urban Roads (Streets).

The outline Table of Contents included previously in the Draft Inception Report was generally agreed at the Inception Workshop, but with the addition of chapters on Hydrology & Drainage Structures and Life-Cycle Costing.
Annex A – List of Key References Reviewed

1. Pavement Design Manual
   - Tanzania Low Volume Roads Manual (AfCAP, 2016)
   - Pave Zambia
   - Perrie, B. Rossman D., Concrete Road construction, Cement and Concrete Institute, 2009.

2. Geometric Design Manual
   - Human Settlement Planning and Design Guidelines, CSIR Building and Construction Technology
   - Botswana Road Design Manual, Botswana Roads Department May 2014
   - Malawi Design Manual for Low Volume Sealed Roads, Jan 2013
• Tanzania Low Volume Roads Manual, 2016
• Civil Engineering Handbook, Chapter 63
• Urban, Rural and Sub-Urban Complete Streets Design Manual for the City of Northampton and Communities in Hampshire County
• City of Johannesburg Complete Streets Design Guideline
• Productive and Liveable Cities – Guidelines for Pedestrian and Bicycle Traffic in Africa, Marius de Langen and Rustica Tembele, A Balkema, 2001
• Towards Safer Roads in Developing Countries. A Guide for Planners and Engineers, 1991