



AfCAP

Africa Community Access Partnership

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa

Second Workshop Report – Sierra Leone and Ghana (Final)



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Cover Image: Scenes from the 2nd round of workshops in Sierra Leone and Ghana

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Abstract

The Research for Community Access Partnership (ReCAP) is funding the preparation of manuals for Low Volume Roads (LVRs) for three AfCAP member countries in the West Africa sub-region. These are Liberia, Sierra Leone and Ghana. The new manuals draw on relevant documentation including manuals recently developed in other ReCAP participating countries and existing material available in the participating countries. The preparation of the manuals includes local stakeholder participation through workshops and a peer review process. The manuals are expected to be published by the end of 2018.

Inputs by local experts are being supplemented by inputs by international experts with experience in the development of rural roads documentation in the Africa region. A series of country visits was conducted in July 2017 and a 1-day stakeholder workshop was held in each country during the second half of September 2017. A second stakeholder workshop was held in Sierra Leone on 29th and 30th January 2018 and in Ghana on 1st and 2nd February 2018. The purpose of these workshops was to consolidate stakeholder engagement in determining, for each manual, the most appropriate scope and style and to verify the relevance of the manual content. The second workshop for Liberia was postponed to March 2018 due to the current national election process.

In all three countries the basic structure of the manual is as follows:

- Part A: Geometric Design and Road Safety;
- Part B: Materials, Pavement Design and Construction;
- Part C: Hydrology, Drainage and Roadside Stabilisation;
- Part D: Complementary Interventions (requested by all three countries); and
- Part E: Maintenance (in Liberia and Sierra Leone).

Part D may be incorporated into Part A as it is relatively short and is relevant to the overall policy context for LVRs.

The level of technical detail in the manuals will broadly reflect the level of detail found in the manuals for LVRs prepared under AfCAP in Ethiopia and Tanzania, while seeking where possible to be more concise. A similar level of detail is expected in the manuals for all three countries. It is anticipated that the manuals could potentially be used to develop curricula for university courses on the design of LVRs, yet retain a practical edge.

None of the manuals will provide guidelines for the design of bituminous seals, as this is available in existing documents and is the subject of a separate ReCAP research project that is underway in the region. However, the guidelines to be prepared under that project could be published as a separate Part of the LVR Manual.

A “zero draft” of each Part of the manual was shared with the workshop participants via a DropBox link ahead of the workshops. The link was also shared with ReCAP management. The participants were requested to provide comments on the zero draft by the end of February 2018.

Practical exercises carried out during the second round of workshops highlighted a number of issues in the zero draft of the manuals, which will be addressed by the authors for the next versions.

Specific findings, recommendations and requests for the three countries are as follows.

- In **Sierra Leone:**
 - it is necessary to generate Rainfall Intensity Duration Frequency curves to be used with the Rational Method included in Part C as a tool for flood estimation. This will require additional budget for the project;

- a copy is required by the CDS project team of the draft Standard Specifications currently being prepared by SLRA;
 - a copy is required by the CDS team of the proposed axle load control policy; and
 - any comments on the draft manual should be sent to the CDS team by the end of February 2018.
- **In Ghana**
 - though DFR has for safety reasons adopted 6m as a minimum carriageway width, the manual will include narrower alternatives to cater for cases where, on account of the very low anticipated traffic, a width of 6m cannot be justified on technical, economic or safety grounds;
 - rainfall Intensity Duration Frequency curves and graphs are available at the Ministry of Roads and Highways (MRH) and the Meteorological Services Agency (MSA);
 - though the potential benefits of the proposed move (informed by AfCAP research) from the CBR-based to DCP/DN-based approach to pavement design are recognised, the manual will include reference to both methods; and
 - an initial deadline of 17th February has been set for comments on the draft manual to be sent to the CDS team, with a final deadline of the end of February.
 - **In Liberia** it will be necessary to generate Rainfall Intensity Duration Frequency curves for inclusion in Part C.

An International Peer Reviewer has been contracted by CDS and national peer reviewers have been contracted for Liberia and Ghana. Discussions are underway with a candidate proposed for the Sierra Leone peer reviewer by the SLRA. The peer review will be carried out in March/April 2018 for Sierra Leone and Ghana. The Liberia peer review will be delayed due to the delay in holding the second workshop. The national peer reviewers each have 8 days of input to review the draft documents.

It is recommended that the output of the parallel ReCAP regional project on surfacing options for LVRs should be included as an additional Part of the LVR Manual. This will enhance the uptake and embedment of outcomes of ReCAP research into practice in the respective countries. This recommendation has been ratified by ReCAP management.

It is recommended that a training project should be implemented in all three countries for potential users of the manual. This training should ideally be carried out before finalisation of the desk top publishing process and printing of the manual in case it results in further modifications.

Key Words

Manuals, Low Volume Roads, Capacity Building, West Africa

Acronyms and Initialisms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transport Officials
AfCAP	Africa Community Access Partnership
ALCC	Association of Liberian Construction Contractors
ALVRS	Alternative Low Volume Road Surfacing
ASTM	American Standard Test Method
AWARE	A West Africa Response to Ebola
BRRRI	Building and Roads Research Institute
BS	British Standard
CBO	Community Based Organisation
CBR	California Bearing Ratio
CCCS	Contractor Classification and Certification System
CDS	Civil Design Solutions
CI	Complementary Intervention
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research (R&D group, Ghana)
CSIR	Council for Scientific and Industrial Research (R&D organisation, South Africa)
DC	District Council
DCP	Dynamic Cone Penetrometer
DFID	Department for International Development
DFR	Department of Feeder Roads (Ghana)
DN	DCP Number (mm/blow)
DUR	Department of Urban Roads (Ghana)
ECOWAS	Economic Community of West African States
EN	European Standard
EPA	Environmental Protection Authority
ESA	Equivalent Standard Axles
ESIA	Environmental and Social Impact Assessment
ESOL	Engineering Society of Liberia
EU	European Union
FR	Feeder Road / Forest Reserve
FRAMP	Feeder Roads Alternative and Maintenance Programme
FRP	Feeder Roads Programme
GASIP	Ghana Agricultural Sector Investment Programme
GCEA	Ghana Consulting Engineers Association
GDP	Gross Domestic Product
GHA	Ghana Highways Authority
GhIE	Ghana Institution of Engineers
GIZ	Gesellschaft für Internationale Zusammenarbeit – German Development Agency
GPS	Global positioning system
GRF	Ghana Road Fund

GRFS	Ghana Road Fund Secretariat
ILO	International Labour Organization
JICA	Japanese International Cooperation Agency
KFW	Kreditanstalt für Wiederaufbau - German Development Bank
KTC	Koforidua Training Centre
L-B	Labour-Based
LSFRP	Liberian Swedish Feeder Roads Project
LVR	Low Volume Road
LVSR	Low Volume Sealed Road
LWD	Lightweight Deflectometer
M&E	Monitoring and Evaluation
MCC	Millennium Challenge Corporation
MDD	Maximum Dry Density
MoFA	Ministry of Food and Agriculture
MLG	Ministry of Local Government
MPBS	Maintenance Performance Budgeting System (Ghana)
MPW	Ministry of Public Works
MRH	Ministry of Roads and Highways
NRSC	National Road Safety Commission (Ghana)
OPRC	Output and Performance based Road Contract
ORN	Overseas Road Note
PI	Plasticity Index
PM	Plasticity Modulus
PIT	Project Implementation Team
PMU	Project Management Unit
PUA	Public Utility Authority (Liberia)
RAI	Rural Access Index
ReCAP	Research for Community Access Partnership
RMFA	Road Maintenance Fund Administration
RMTC	Road Maintenance Training Center
RPM	Road Prioritisation Methodology
RSC	Road Safety Commission
SC	Steering Committee
SCADeP	Smallholder Commercialization and Agribusiness Development Project
SI	Site Investigation
Sida	Swedish International Development Agency
SL	Sierra Leone
SLRA	Sierra Leone Roads Authority
SMTDP	Sector Medium Term Development Plan (Ghana)
SN	Structural Number
SPT	Standard Penetration Test
SRI	Soils Research Institute
SSD	Single Surface Dressing
TA	Technical Assistance

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa

ToT	Training of Trainers
TRH	Technical Recommendations for Highways
TRL	Transport Research Laboratory (UK)
UK	United Kingdom (of Great Britain and Northern Ireland)
UL	University of Liberia
UN	United Nations
USAID	United States Agency for International Development
WAFEO	West African Federation of Engineering Organisations
WB	World Bank
WHH	Welthungerhilfe (Liberia)

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1 Introduction

1.1 Background to the Project

The Research for Community Access Partnership (ReCAP) is seeking to influence future policy in the roads sector by helping ensure that recommendations arising from high quality research established under the Africa Community Access Partnership (AfCAP) Phase 1 are put into practice. As part of this approach, new design manuals specifically for Low Volume¹Roads (LVRs) customised to national needs and practice have been, and are being, developed. Such manuals have so far been published under ReCAP/AfCAP in Ethiopia, South Sudan, Malawi, Tanzania, Mozambique and Kenya. These manuals are based on the results of over 30 years of research on low volume rural roads, both paved and unpaved.

1.2 Objectives

The objective of the project is to prepare manuals for low volume roads in Ghana, Sierra Leone and Liberia based on a review, adaption and expansion of previous AfCAP LVR manuals, local manuals that are available in these countries and other relevant international documentation.

The objective of the manuals is to provide, in each country, a relevant resource, based on recognised good practice, that will help build capacity and result in improved sector performance.

1.3 Approach

The approach to the development of manuals has been extended beyond the original scope, which focussed mainly on road design standards. It is accepted that the sustainable provision of low volume rural roads depends on a holistic approach that also recognises the importance of other considerations including design procedures, works specifications, procurement of works and supervision services, construction methods, and quality management. Increasing emphasis is being given to road maintenance as part of rural roads asset management. The approach provides opportunities for local stakeholders to provide their input to the manuals preparation process to ensure that the final outputs are relevant to the local context.

¹Under ReCAP, “Low Volume” roads are considered to be those that, over their design life, are required to carry an average of up to about 300 vehicles per day and are subjected to less than about 1million equivalent standard axles.

2 Workshop reports

2.1 Workshop Objective

The objective of the second stakeholder workshops was to discuss and agree with stakeholders in the participating countries the identified design options for LVRs to be included in the new manuals. The overall scope of the manuals was agreed at the first workshops held in September 2017.

2.2 Workshop Format

Two-day workshops were held in each country in accordance with the requirements of the project Terms of Reference. The workshops were organised by the partner road agencies, who were responsible for inviting the participants and arranging the venue and catering. The structure of the workshops was based on presentations by the technical experts on the CDS team followed by discussion periods and practical exercises.

2.3 Sierra Leone Workshop

2.3.1 Overview and Programme

The workshop was held at the SLRA offices in Freetown on 29th and 30th January 2018. It was attended by 41 people including the CDS team and ReCAP management, and representatives of the SLRA, local consultants and the university. The attendance list is included in Annex A. Most of the participants attended all sessions of the workshop, except the final session on day 2, which was attended mainly by SLRA technical staff.

The workshop was facilitated by the SLRA Deputy Director for Administration, Mr S Jawara.



Figure 2-1: Sierra Leone Workshop in Progress

Table 2-1: Sierra Leone Workshop Programme

	Time	Activity	Presenter/Facilitator
Monday 29 th January	10:00 to 10:05	Prayers and Introduction	
	10:05 to 10:15	Welcoming remarks	Director General SLRA
	10:15 to 10:30	Introduction, and overview of approach	Team Leader
	10:30 to 10:50	Part A: Geometric Standards and Road Safety (including Route Selection)	Geotechnical Expert and Geometric Expert
	10:50 to 11:20	<i>Part A: Feedback and discussion</i>	
	11:20 to 11:30	<i>Introduction to Exercise A</i>	Geometric Expert
	11:30 – 11:45	Tea/Coffee break	
	11:45 – 13:00	Participants undertake Exercise A	
	13:00 – 13:30	<i>Exercise A: Feedback and discussion</i>	Geometric Expert
	13:30 – 14:30	Lunch break	
	14:30 – 14:50	Part C: Hydrology, Drainage, and Roadside Stabilisation	Drainage Expert and Geotechnical Expert
	14:50 – 15:20	<i>Part C: Feedback and discussion</i>	
	15:20 – 15:30	<i>Introduction to Exercise C</i>	Drainage Expert
	15:30 – 16:00	Participants start Exercise C	
	16:00 – 16:30	Tea/Coffee break	
	16:30 – 17:00	Participants continue Exercise C	
	17:00 – 17:30	<i>Exercise C: Feedback and discussion</i>	Drainage Expert
17:30	Participants depart for day, to reconvene at 10:00 Friday		
Tuesday 30 th January	Time	Activity	Presenter/Facilitator
	10:00 to 10:15	Reconvening and review	Team Leader
	10:15 to 10:35	Update on SCADEP (road component)	SLRA Feeder Roads Engineer
	10:35 to 11:15	Part B: Materials, Pavement Design, and Construction (including Site Investigations)	Geotechnical Expert and Pavement Expert
	11:15 to 12:00	<i>Part B: Feedback and discussion</i>	
	12:00 – 12:15	Tea/Coffee break	
	12:15 to 12:30	<i>Introduction to Exercise B</i>	Pavement Expert
	12:30 – 13:30	Participants undertake Exercise B	
	13:30 – 14:00	<i>Exercise B: Feedback and discussion</i>	Pavement Expert
	14:00 – 15:00	Lunch break	
	15:00 – 15:15	Part D: Complementary Interventions	Team Leader
	15:15 – 15:30	<i>Part D: Feedback and discussion</i>	Team Leader

15:30 – 15:45	Part E: Maintenance	Team Leader
16:00 – 16:15	Tea/Coffee break	11:45 – 12:00
16:15 – 16:45	Summary of results of workshop and next steps	Team Leader
16:45 – 17:00	Closing remarks	Deputy Director General of the SLRA
17:00	Participants depart	

2.3.2 Sierra Leone workshop proceedings

The Director of the SLRA made introductory and welcoming remarks.

The workshop was attended by the ReCAP Deputy Team Leader and Infrastructure Research Manager, Nkululeko Leta (both days), and the ReCAP Regional Technical Manager for West Africa, Paulina Agyekum (first day only). Eng Leta made some opening remarks concerning the objectives of ReCAP support to the rural roads sector in Sierra Leone and West Africa.

The CDS Team Leader introduced the project for preparation of the LVR Manual including the project objectives, approach and methodology. He reminded the participants of the definition of Low Volume Roads and the importance of considering the entire Road Environment in the provision of LVRs. He summarised progress to date and outlined the workshop programme. The presentation is included in Annex C.

Each of the technical experts on the CDS team delivered a PowerPoint presentation outlining the content of the sections of the manual that they are responsible for. The presentations were received positively by the participants and there were a number of contributions from the group. The presentations are included in Annex C.

The Geometric Design, Drainage Design and Pavement Experts led practical exercises which required the workshop participants to use sections of the draft manual. Printed handouts were distributed to the participants as necessary and relevant parts of the manual were shown on the screen to assist those that did not have a notebook computer at the workshop with the draft manuals on it. Some of the practical work was done in small groups and some as a single group of participants. The practical exercises generated significant discussion in the group. They also highlighted several issues in the draft documents that should be attended to by the authors. Most of these anomalies concerned data provided in some of the tables within the manual. Details of the practical exercises are presented in Annex D.

The Sierra Leone workshop included a presentation by Tamba K. Amara, the Senior Engineer in the SLRA Feeder Roads Department, on the Smallholder Commercialization & Agribusiness Development Project (SCADEP) which is being co-funded by DFID and the World Bank. SCADEP includes a feeder road component which would benefit from the application of the standards included in the new LVR Manual. The presentation is included in Annex C.

In his closing remarks at the end of the workshop, the Deputy Director General of the SLRA noted that, as a result of the practical exercises carried out during the workshop, practitioners were no longer daunted by the size and complexity of the manual.

2.3.3 Issues Arising

The following are the key issues arising during the discussions, and agreements made.

Geometric Design Standards and Road Safety

- A new “S2” class of secondary road has been proposed for LVRs carrying more than 100 VPD. There was no objection to this proposal but also no clear endorsement. It was noted that if the S2 road carries more than 80 heavy vehicles the manual recommended that it should be classified as a Type S1 secondary road and designed as a high-volume road.

- A new Sierra Leonean policy on axle load control has been approved by Parliament. Based on ECOWAS policy, this has not yet been published by the government. The CDS team requested copy of the policy.
- It was agreed that some strategic roads with low traffic might be given greater importance, but this is an exception. The manual is for general LVR practitioners and to be applied to the general LVR network.
- Super-elevation details will not be provided in the Manual as an option on unpaved roads. Superelevation results in increased erosion on the inside of the curve due to the distance rain water needs to travel across the road surface. As a result, the inside part of the road may become unusable.
- Additional signage is required on unpaved roads as it is not possible to provide road markings.
- Road signs should comply with the (new) SLRA Road Design Manual and the Highway Code. They are based on British Standards. (The CDS team was not previously aware of the SLRA Road Design Manual - it was provided to the team during the workshop by one of the participants in electronic form. Its relevance to LVRs has not yet been assessed).
- The photos of road safety interventions should show a yellow edge line, which is standard in Sierra Leone.
- If the traffic volume is on the boundary between different traffic classes, there are other factors that should be considered in deciding which class to use. Guidance is required in the manual.
- Table A.5.6 on Right of Way widths. It was agreed that 17m was an appropriate Right of Way for F1, F2 and F3 roads. Consider whether this table should appear earlier in the document.
- Table A.4.2 on turning radii. The figures in the table need to be checked.
- Page 35 of Part A – review the definition of “mountainous” terrain.
- Section 5.4.4 on intersection sight distances – review the figure given for trucks.
- Table A.5.3 on passing sight distances. Review the figures in the table (feeder roads shown as requiring longer sight distances than secondary roads).
- Table A.5.7 on horizontal curvature – check the values of camber given in the table.
- Table A.5.9 on curve widening - check the figures given in the table, particularly for Radius < 150m.
- Review the need for gravel shoulders on unpaved roads (in addition to the 6m carriageway).
- Review the side drain detail in populated areas – consider a lined V drain that vehicles can pass through.

Hydrology and Drainage

- A participant asked why the manual recommended the use of “outdated” nomographs when modern computer-based methods are available. It was noted that the computer-based options are described in the manual, but it is felt that the users of the manual should also understand the “first principles”.
- A study is needed to convert existing rainfall data into Intensity Duration frequency curves for use in the Rational Method. If this is not done it will not be possible to use the manual to estimate flow using the Rational Method.
- It was recommended that a simplistic approach be included in the manual for the design of culverts on LVRs with small catchments. It was therefore suggested that the recommended standards in the Ghana DFR Design Guidelines should be used.

Slope Stabilization

- Stabilization techniques can be seen on the road up to the university in Freetown.
- If possible the name/specification for suitable grasses to be used in bioengineering should be included in the manual.

- A participant asked how causes of slope failure can be determined on site. This is done through a site inspection looking for water seepage, the nature of exposed material, land use above the road etc.
- If in doubt the engineer should call in expert advice as landslides can be fatal.
- Guidance was requested on how to select the appropriate road cross-section in sidelong ground i.e. cut/fill or full cut. This should include guidance on, for example, how to dispose of excess cut material.
- Guidance was requested on the construction of embankments in coastal areas and swamps. (Some advice on embankment is already included in the chapter on Site Investigations.)
- Consistency is required between guidance on slope angles in the roadside slope stabilisation chapter and the guidance on side slope in geometric design (Table A.5.5).
- Guidance was requested on what to do in adverse soils and adverse rock jointing.
- The manual should include specifications for rockfill and gabions.

Site Investigations

- The list of typical soils found in Sierra Leone should include coastal sands.
- Sierra Leone uses both British Standard and AASHTO test methods.
- The manual should discuss relationship between the Standard Penetration Test (SPT) and the Dynamic Cone Penetrometer Test (DCP).

Materials and Pavement Design

- There is currently no axle load control in Sierra Leone. A study funded by the EU is reviewing the local implementation of the ECOWAS policy.
- Table B.2.2 lane distribution factors- remove the first row where the sum of the ESA's is doubled for carriageway < 3.5m; and remove the row for roads with more than 2 lanes in each direction.
- It was proposed that the following traffic classes should be adopted: < 0.1 mesa, 0.1-0.3 mesa and 0.3-1.0 mesa. Alternatively, there could be 2 classes: < 0.3 mesa and 0.3-1.0 mesa.
- Guidance is required for road construction on low density coastal sands.
- The tables for subgrade classes and subgrade improvement options should include for DN values and not only be based on CBR.
- 95% Mod AASHTO density is recommended for subgrade (as opposed to 94% currently shown).
- All materials specifications discussed in the manual should be grouped into one chapter.
- A draft version of Standard Specifications for Sierra Leone is under preparation. A copy of the draft was requested by the study team.
- Materials specifications for base and sub-base should include recommended limits for DN values.
- The catalogue type thickness designs provided in the various tables need to be verified. The current values appear to result in overly thick pavement layers, higher construction costs and ineffective use of scarce materials.
- The formula and tables for estimating the gravel loss in the manual requires review to ensure it is relevant to Sierra Leone with its high rainfall. Reference should be made to the ILO gravel loss study undertaken in Ghana and the formula in ORN 8.

Complementary Interventions

- The ESIA process for road improvement projects can be used to identify CIs as the ESIA study is undertaken in the communities.

Maintenance

- References to super-elevation on gravel roads in Part E should be removed.

Way Forward

- Participants were requested to provide any comments on the draft manual to the CDS team by the end of February 2018.
- The peer review process is expected to start in March 2018 and the MS Word versions of the document are expected to be complete by June.

2.4 Ghana Workshop

2.4.1 Overview and Programme

The workshop was held at the DFR Offices in Accra on 1st and 2nd February 2018. It was attended by a total of 49 participants. 43 people participated on Day 1, and 39 on Day 2, of which 35 participated on both Day 1 and Day 2. Participants included:

- the CDS team;
- ReCAP PMU
- DFR staff (both from head office, and from the Regions);

and representatives from:

- the Ghana Highway Authority (GHA);
- the Ministry of Roads and Highways (MRH);
- the Road Fund Board;
- Kwame Nkrumah University of Science and Technology (KNUST);
- The Ghana Institution of Engineers(GhIE); and
- The Building and Road Research Institute (BRR)

The attendance list is included as Annex B, which also indicates who participated on each day of the workshop. The workshop was presided over by Eric Duncan-Williams, the Director of Feeder Roads, and facilitated for DFR by Dr Patrick Bekoe.

Photographs of the workshop presentations, feedback sessions, and exercise are presented as Figures 2-2, 2-3, and 2-4 respectively.

The workshop programme, as provided to participants in advance, is presented as Table 2-2.

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa



Figure 2-2: Ghana Workshop presentations in progress



Figure 2-3: Ghana Workshop feedback sessions in progress



Figure 2-4: Ghana Workshop exercises in progress

Table 2-2: Ghana Workshop Programme

	Time	Activity	Presenter/Facilitator
Thursday 1 st February	08:30 to 08:45	Welcoming remarks	Chief Director, DFR, & AfCAP
	08:45 to 09:00	Introduction, and overview of approach	Ghana Team Leader
	09:00 to 09:30	Part A: Geometric Standards and Road Safety	Geotechnical Expert Geometric Expert
	09:30 to 10:15	<i>Part A: Feedback and discussion</i>	
	10:15 to 10:30	<i>Introduction to Exercise A</i>	Geometric Expert
	10:30 – 10:45	Tea/Coffee break	
	10:45 – 11:45	Participants undertake Exercise A	
	11:45 – 12:30	<i>Exercise A: Feedback and discussion</i>	Geometric Expert
	12:30 – 13:15	Lunch break	
	13:15 – 13:45	Part C: Hydrology, Drainage, and Roadside Stabilisation	Hydrology & Drainage Expert Geotechnical Expert
	13:45 – 14:30	<i>Part C: Feedback and discussion</i>	
	14:30 – 14:45	<i>Introduction to Exercise C</i>	Hydrology & Drainage Expert
	14:45 – 15:00	Tea/Coffee break	
	15:00 – 16:00	Participants undertake Exercise C	
	16:30 – 16:30	<i>Exercise C: Feedback and discussion</i>	Hydrology & Drainage Expert
16:30	Participants depart for day, to reconvene promptly by 08:30 Friday		
Friday 2 nd February	08:30 to 09:00	Reconvening and review	Ghana Team Leader
	09:00 to 09:30	Part B: Materials, Pavement Design, and Construction	Geotechnical Expert Pavement Design Expert
	09:30 to 10:15	<i>Part B: Feedback and discussion</i>	
	10:15 to 10:30	<i>Introduction to Exercise B</i>	Pavement Design Expert
	10:30 – 10:45	Tea/Coffee break	
	10:45 – 11:45	Participants undertake Exercise B	
	11:45 – 12:30	<i>Exercise B: Feedback and discussion</i>	Pavement Design Expert
	12:30 – 13:15	Lunch break	
	13:15 – 13:30	Part D: Complementary Interventions	Ghana Team Leader
	13:30 – 14:00	<i>Part D: Feedback and discussion, with examples</i>	
	14:00 – 15:00	Identification/summary of issues to be addressed	DFR Facilitator

15:00 – 15:15	Summary of results of workshop and next steps	Ghana Team Leader
15:15 – 15:30	Closing remarks	Director of Feeder Roads
15:30	Participants depart	

2.4.2 Ghana workshop proceedings

Following a series of brief self-introductions by participants, the Director of Feeder Road made welcoming remarks, highlighting his hope that the manual would include examples of the practical application of the various step by step design procedures described. The ReCAP Regional Technical Manager for West Africa, Paulina Agyekum, then thanked DFR for arranging the event and encouraged all participants to engage fully in the workshop activities.

The CDS Team Leader for the Ghana Manual then set the context for and objectives of the workshop, highlighting its primary function as considering its content and its scope, that had been broadly agreed at the previous workshop. While pointing to the important contribution that the manual could make to sector performance, he stressed the need for parallel initiatives, including practical training, a focus on strengthened accountability mechanisms, building of trust between stakeholders, and a clear and enabling institutional and legal environment. His presentation, which concluded with an outline of the workshop programme, is included in Annex E.

The ReCAP Deputy Team Leader and Infrastructure Research Manager, Nkululeko Leta then reiterated the need for the Manual to be practically-focussed, relevant to the Ghanaian context, and to enjoy a high sense of ownership among stakeholders.

During the remainder of the workshop, each of the technical experts on the CDS team delivered a PowerPoint presentation outlining the content of the sections of the manual for which they are responsible. The presentations were received positively by the participants, and were marked by a high degree of interaction, both during the presentations themselves, and in the course of subject periods devoted to questions and feedback. All the presentations are included in Annex E.

The Geometric Design, Drainage Design and Pavement Experts led practical exercises which required the workshop participants to use sections of the draft manual. Printed handouts were distributed to the participants as necessary and relevant parts of the manual were shown on the screen to assist those that did not have a notebook computer at the workshop with the draft manuals on it. Some of the practical work was done in small groups and some as a single group of participants. The practical exercises generated significant interest from and engagement by all participants. Details of the practical exercises are presented in Annex F.

2.4.3 Issues Arising

The following are the key issues arising during the discussions and agreements made.

General

- There was a general comment calling for more internal cross-referencing within the manual
- The manual should give flexibility to Engineers to adopt suitable technologies where the need be e.g. geotextiles.
- The representative from the Road Fund Board asked that in addition to the Manual, there should be associated software tools to facilitate the practical application of the various design processes described in the manual. Though this would be beyond the scope of the Manual, it was agreed that the manual should be as clear as possible about the various design processes.
- As a general point, several cases were encountered where historic Ghanaian standards exist, but are not necessarily fully applied in practice, whether as a result of lack of resources, or because they are no longer considered by Ghanaian practitioners to be relevant in all regards. Participants agreed on the importance of identifying and resolving all such

inconsistencies, so that due account is taken of existing standards in those cases when it is agreed that they remain relevant and applicable.

- It was noted that details adopted in the Manual for standard vehicles (in terms of dimensions and loadings) were not consistent with the "*HDM-4 Configuration and Calibration for Ghana*" document prepared by the University of Birmingham in 2007 for the Government of Ghana. Further reference will be made to this document where appropriate.
- It was agreed that Part D of the Manual should be incorporated into Part A. Though Part A will serve as a detailed introduction to all Parts of the Manual, all Parts will include sufficient introductory content to serve as stand-alone documents.
- There was concern among some participants that the draft manual was too long and contained too much text, rather than bullet points and summary statements.
- One participant suggested expanding on the passing reference to the procurement cycle made in Part A, while making better and clearer use of graphics to illustrate the relationship between the various steps in the design process.

Geometric Design Standards and Road Safety

- During the presentation on route selection, the issue was raised of political interference in the identification of both routes and projects. It was agreed in discussion that DFR's Road Prioritisation Methodology (RPM) helps guard against such interference, and that more generally it is possible to mitigate such risks through a combination of transparency and clear processes including Multi-Criteria-Analysis (MCA) in which agreed weights are assigned in advance to various factors, potentially including political considerations.
- Clearer guidance was requested on the use of the MCA technique in route selection. Participants requested that the worked example that is contained in the Liberia and Sierra Leone documents be included in the Ghana document.
- Some participants found the road classification table, based on AADT and level of service, to be problematic, as it did not fully reflect some aspects of the Ghanaian context, such as DFR's policy of not allowing a carriageway width of under 6 metres. Other participants considered it important that the manual should include a lower standard for use on very low volume roads, including those undertaken by the Ministry of Agriculture and the Local Governments under the Ministry of Local Government and Rural Development. The DFR Facilitator suggested that one way of reconciling these different perspectives would be for Type 1 to be designated as being for traffic levels of 1-15 vpd, and for Type 2 to be up to 75, without specifying a lower limit. The Type 1 road width of 4.5m should be applied to tracks. It was agreed that this table, which is of fundamental importance to the design process, should be revisited through ongoing consultations over the coming weeks.
- It was noted that the table of road reserves in the manual is not consistent with the provisions of the "*Road Reservation Management: Manual for Coordination*". It was understood by some participants that modifications have been made to this document since it was published. It was agreed that the LVR Manual should reflect the latest official decisions concerning road reserves.
- It was noted that some details such as the terrain classification were not consistent with the GHA's "*Road Design Guide*" issued in 1991. This will be considered further, and account also taken of international standards that have since been developed.
- A participant queried why no reference was made to climbing lanes. It was clarified that the traffic threshold at which climbing lanes would normally be considered was higher than that encountered on LVRs. It was proposed that since there is no consideration for climbing lanes, provision should be made for widening the road at hilly sections instead of having a constant width of say 6m throughout.
- A participant noted that, though reference was made to Road Safety Audits, there was no elaboration as to the details of such audits, such as their scope. It was suggested that some basic further elaboration would be helpful.

- Concern was raised about road safety implications of the recommendation that super-elevation should not be applied on LVRs. The manual recommends this on account of the increased associated risk of damage to the road resulting from water flows on the carriageway. Such damage could itself constitute a road safety risk, and in practice vehicles could still in most cases cross the carriageway if necessary in order to avoid an adverse camber. The issue was not resolved, but it was agreed that further attention would be given to this issue.
- It was clarified that DFR's standard approach to traffic counts entails 6am to 6pm counts on a market day, and a non-market day, with associated account being taken of the effect of weekends.
- DFR reiterated that its approach to road signs and traffic markings for LVRs' was the same as described in the GHA guidelines on the topic.
- The manual currently refers to SADCC road signs and markings, which comply with international standards that Ghana has signed but not ratified. It was agreed that the team would be provided with the *Ghana Highway Code*. This would enable them to clarify whether there is in fact any divergence between Ghanaian and international standards, and if possible simply refer to the Ghana Highway Code.

Hydrology and Drainage

- It is understood that a study has been undertaken to update Ghana's Intensity Duration Frequency curves to be used in the Rational Method, but that the resulting curves have not yet been published. A participant clarified that these can now be obtained from MRH.
- Based on international research, the manual recommends an upper catchment area limit of 10 km² for the use of the Rational Method without modification. It is, however, readily acknowledged that this is somewhat arbitrary threshold that could potentially result in the costly over-sizing of culverts draining catchments in the range 5 km² to 10 km². It was agreed that this issue (of upper limit to the Rational Method before an adjustment factor is applied) will be considered further, including as part of the peer review.
- It was noted that the Manual does not make provision for cases where the natural storage effect of swamps and ponds within a catchment could result in a gross over-estimation of discharge flows if the Rational Method is blindly applied. It was agreed that the Manual will make reference to this risk, and further stress the importance of field verification of all cross-drainage structures, to ensure that the results of the calculations appear credible on site.
- It was noted that some of the tables (such as for the spacing of mitre drains) in the Manual are not always fully consistent with the provisions of the *DFR Design Standards*.

Slope Stabilization

- In response to participants' queries about why certain stabilisation techniques were not recommended for LVRs it was clarified that, while the issues being faced are similar to those on more heavily trafficked roads, the associated risks are lower, so it is important that low cost solutions are adopted wherever possible.
- The Director highlighted DFRs interest in the use of bio-engineering including grass. In a subsequent discussion, participants did not consider there to have been any specific research into this, and application, in Ghana.
- Additional text should be included to discuss the potential use of geosynthetics. This is mostly concerned with subgrade improvement/stabilisation, rather than slope stabilisation, but reference should, for example, be made to earth-reinforced structures.

Site Investigations

- The Soils Research Institute may be able to provide additional data on soils in Ghana.
- The Directorate of Geological Survey is now the Ghana Geological Survey Authority

- Issues were raised concerning practical challenges associated with the use of the DCP, including the effect of soil moisture content and tension drag in clay soils. These need to be referred to.
- It was pointed out that it is not just the Right of Way (RoW) that needs to be considered in site investigations. The road can be affected by processes occurring outside of the RoW and therefore the geographical scope of the site investigation needs to be sufficiently broad to ensure this.
- It was agreed that some sort of document (beyond the scope of this manual) needs to be prepared to alert DFR to the site investigation issues that could typically prevail in specific areas of the country.

Materials and Pavement Design

- Some participants were interested in the scope for geosynthetic applications on unpaved roads. It was clarified that this would not normally be considered viable on economic grounds, but it would be considered to include some guidance under the subgrade improvement section.
- Several discussions concluded with agreement that, on account of the need (for economic reasons) to optimise the use of available materials, the design solutions for LVRs can at times call for innovative solutions.
- A participant expressed concern about “merging” the CBR and DCP/DN approaches to pavement design. It was clarified that the Manual presents both methods, so does not limit the options available to the designer. While there is an increasing body of research to suggest that scope potentially exists for achieving better value for money through use of the DCP/DN approach, the DFR made a strong case for maintaining the CBR design method as a separate design option and expressed concern about the accuracy of the equations describing the relationship between in situ DN values and CBR values.
- The current Ghanaian charts for subgrade classification and wearing course material classification (based on Shrinkage Product and Grading Coefficient), as included in the DFR’s *Soils and Natural Gravels Guideline of Area Engineers*, were discussed as being appropriate and the DFR’s Regional Engineers would include some comments and practical experience in the feedback by the 17th of February.
- The formula and tables for estimating the gravel loss in the manual requires review and reference should be made to the ILO gravel loss study undertaken in Ghana and the formula in ORN 8.
- The participants agreed that crushed rock bases are not utilised in low volume road pavements structures in Ghana.
- Reference was made to a study having been undertaken on the use of marginal materials in road construction. The CDS consultants requested a copy of this.
- Crushed stone is referred to in DFR documentation as “rock base”.

Complementary Interventions

- Participants clarified that the concept of Complementary Interventions (CIs) is already well established, citing examples of the re-design of culvert aprons to provide water storage, and the use of a road contract to support a community water development project. However, the associated mechanisms and processes are not clearly defined, and decisions about such arrangements tend to be opportunistic.
- Similarly, the interaction between District, Regional and DFR planning processes tends to be flexible and responsive, with no specific provision for identifying potential for CIs. In the subsequent discussion it was agreed that DFR’s RPM provides a natural platform for such issues to be included as part of the standard planning process.

- One participant questioned why an engineering design manual should include reference to CIs and targeted procurement. The CDS Ghana Team Leader highlighted the importance of the design engineer understanding the context in which technical design is undertaken, so that benefits of the investment can be optimized and risks mitigated.

Legal and Regulatory Environment

In the course of a short additional ad-hoc discussion facilitated by the CDS Team Leader for the Ghana Manual, participants brainstormed the scope and details of legal and regulatory provisions that have a bearing on LVRs in Ghana. Consideration was given to a wide range of issues including:

- the legal definition of specific roads;
- the legal status of the various manuals being used;
- the legal mandate under which DFR, GHA and others work in LVRs;
- feasibility and non-feasibility legal liabilities for activities undertaken or not undertaken respectively, by the authorities responsible for constructing and maintaining LVRs;
- the legal basis for safety provisions related to the physical infrastructure of LVRs, including Ghanaian ratification of international conventions;
- the legal basis for environmental protection measures, including Ghanaian adoption of international standards;
- the legal basis for DFRs approach to deconcentration² in the context of decentralisation;
- applicable labour laws, including Ghanaian acceptance of international labour standards;
- applicable policies regarding planning processes;
- applicable policies regarding public disclosure and transparency related to road works;
- applicable policies regarding targeted procurement in relation to:
 - technology choice;
 - national contractors; and
 - small contractors.
- applicable professional standards and codes of conduct for engineers, QS's and other professional working in the road sector;
- classification, registration and monitoring of the performance of consultants;
- classification, registration and monitoring of the performance of contractors.

As a result of this exercise it was clarified that:

- There is no "Road Act" as such in Ghana;
- DFR's mandate is based on a Presidential Decree;
- The Road Safety Act is yet to be ratified by Parliament;
- Environmental Laws are in place and applied;
- The Labour Act 2003 is in place and applied;
- The Local Governance Act 2016 helped remove some previous inconsistencies concerning decentralisation, but the implementation of some aspects of decentralisation still lag behind the aspiration of the law.

The relevance of such issues to the Manual is the importance of there being clarity over the source and nature of relevant legal, regulatory and policy provisions. The Manual will simply include a list of such sources.

Way Forward

²Deconcentration is the term used by DFR to describe the process whereby its Head Office transfers some of its responsibilities to lower-level units (such as at the Regional level) that remain within its jurisdiction

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa

- Participants were requested to provide any comments on the draft manual to the CDS team by 17th February 2018, to allow the revision of the draft Manual to then proceed in as fully informed a manner as possible. Further feedback and comments received by the end of February will also be taken into account before the start of the national Peer Review process.
- The national Peer Review process is expected to start in March 2018 and be followed by the international Peer Review. The MS Word versions of the document are expected to be complete by June.

Liberia Workshop

The Liberia workshop was postponed until the latter half of March 2018 due to the recent national election process. The election is expected to result in management changes in the Ministry of Works, which will host the workshop.

Annex A. Workshop Participants–Sierra Leone

S.N.	NAME	POSITION	INSTITUTION
1	Nkululeko Leta	Deputy TL & Infrastructure and Research Manager	ReCAP/ AfCAP
2	Paulina Agyekum	WA Manager ReCAP	ReCAP / AfCAP
3	Abdul Nasser Fofanah	Engineer	SLRA
4	Alexander George	Senior Admin Officer	SLRA
5	Alfred J Momodu	CE / PIU	SLRA
6	Ansumana Abdulai	Director of Maintenance	SLRA
7	Arthur Solo Harvey	Chairman	SLRA
8	Daniel J Wisman	Dir of Development	SLRA
9	Dr. S E Gbembo	DDG	SLRA
10	Francis S Bockarie	Chief Engineer	SLRA
11	George Nyuma	Director	SLRA
12	Ibrahim S. Boime	M&E Engineer	SLRA
13	Lauretta Dumbuya	Senior Engineer	SLRA
14	Lucy T Essa	SEO	SLRA
15	Melvin B D Scott	Manager, M & E Unit	SLRA
16	Memuna K Jalloh	DG	SLRA
17	Moinama Kpaka	Eng	SLRA
18	Patrick J Lavalie	Assist Eng Environment	SLRA
19	Phodie M Kamara	Senior Engineer	SLRA
20	Samuel J Macauley	Eng. DFR	SLRA

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa
Annex A: Workshop Participants – Sierra Leone

S.N.	NAME	POSITION	INSTITUTION
21	Sidie M Jawara	Deputy Director of Administration	SLRA
22	Tamba K Amara	Chief Engineer	SLRA
23	Tamba Yonga	Road Asset Manager	SLRA
24	Tesslime Shyllon	Eng. DFR	SLRA
25	Abdul J D Shaw	Ag. Chief Engineer	MWHI
26	Abdul Koroma	Civil Engineer	University of SL
27	Abdul Bakarra Sesay	Manager	Team of Three
28	Abdul Raham Sesay	Contractor	SANNU
29	Adolphus Jackson	T A	SCADEP
30	Alpha Lavalie	Operations Director	ICS Ltd
31	Ibrahim Joshua Sasay	Civil Engineer	ICS Ltd
32	Ibrahim Turay	Civil Engineer	ICS Ltd
33	Mohamed Lahai	District Engineer Tonkolili	KAM Ent
34	Tamba Kanje	Civil Engineer	MAFFs
35	John Conteh	Engineer	Mylans
36	Sheku Sesay	Contractor	Caisey Construction General Services
37	Festus Odametey	Hydrologist / Drainage	CDS
38	Gareth Hearn	Geologist	CDS
39	Lucas Jan Ebels	Pavement & Materials	CDS
40	Robert Geddes	Team Leader	CDS
41	Ronald Isaac	Rural Roads	CDS

Annex B. Workshop Participants – Ghana

S.N.	NAME	POSITION	INSTITUTION	ACCESS TO DRAFT	ATTENDED DAY 1	ATTENDED DAY 2
1	Nkululeko Leta	Deputy Team Leader, ReCAP	ReCAP	YES	YES	
2	Paulina Agyekum	Technical Manager, West Africa	ReCAP	YES	YES	YES
3	Eric Duncan-Williams	Director	DFR	YES	YES	YES
4	Bernard Badu	Deputy Director (Development)	DFR	YES	YES	YES
5	Roosevelt Odai Otoo	Deputy Director (Maintenance)	DFR	YES	YES	YES
6	Herbert Koranteng	Chief Engineer, Dev & Safety	DFR	YES		YES
7	Joseph K. Idun	Chief Quantity Surveyor	DFR	YES	YES	YES
8	K.N. Akosah- Koduah	Chief Engineer	DFR	YES		YES
9	Lawrence Abbew	Chief Quantity Surveyor	DFR	YES	YES	YES
10	Peter K Yawson	Chief Engineer	DFR	YES	YES	YES
11	S. N. Sarpei-Nunoo	Chief Engineer	DFR	YES		YES
12	Abudulai Braimah	Regional Manager, (Central)	DFR	YES	YES	YES
13	Bruku Boateng	Regional Manager, (Upper East)	DFR	YES	YES	
14	Castro Nyoagbe	Regional Manager (Northern)	DFR	YES	YES	YES
15	Caun Afari-Kumah	Regional Manager, (Western)	DFR	YES	YES	YES
16	Edmund Kwaku Duodo	Regional Manager	DFR	YES	YES	YES
17	Gregory Amissah	Regional Manager	DFR	YES	YES	YES
18	Joseph E Miezah	Regional Manager (Greater Accra)	DFR	YES	YES	YES
19	Justice Koranteng	Regional Manager (Upper West)	DFR	YES	YES	YES
20	Seth Osei Nketiah	Regional Manager (Eastern)	DFR	YES	YES	YES

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa
Annex B: Workshop Participants – Ghana

S.N.	NAME	POSITION	INSTITUTION	ACCESS TO DRAFT	ATTENDED DAY 1	ATTENDED DAY 2
21	Abudulai Braimah	Principal Engineer, DFR	DFR	YES		YES
22	Akwasi Buoh Asamoah	Principal Engineer	DFR	YES	YES	YES
23	Ben Nelson K Abledu	Principal QS	DFR		YES	
24	Bugapeh Charles	Engineer	DFR	YES	YES	YES
25	Don F. Kuubeterzie	Principal Engineer	DFR	YES	YES	YES
26	Efua Akwatea- Mensah	Principal Engineer – DRM	DFR	YES	YES	YES
27	Evans Tutu Akosah	Civil Engineer	Ablin Consulting Engineers & Planners Ltd	YES	YES	YES
28	James Oppong	Principal Engineer	DFR	YES	YES	YES
29	K Omane Brimpong	Principal Engineer	DFR	YES	YES	YES
30	Nathan Odjao	Bridge Maintenance Engineer	DFR	YES	YES	YES
31	Patrick Amoah Bekoe	Principal Engineer	DFR	YES	YES	YES
32	Robert R K Quaye	Engineer	DFR	YES	YES	YES
33	Samuel Yaw Banini	Principal Engineer	DFR	YES	YES	
34	Eric Odosu	MM/SS, GHA	GHA	YES	YES	
35	Nana Kidesi Agyepong	Director of Materials, GHA	GHA	YES	YES	YES
36	Emmanuel Gbadago	Principal Engineer, MRH	MRH		YES	YES
37	Joseph Oddei	GhIE Representative	GhIE	YES	YES	YES
38	Charles Adams	KNUST	KNUST	YES	YES	YES
39	Edmund Kwasi Debrah	Senior Research Scientist (BRR) (part of CSIR)	BRR	YES	YES	YES
40	Charles Bopoto	International Peer Reviewer	CDS	YES	YES	YES
41	Daniel Obeng	CDS National Engineer	CDS	YES	YES	YES

Development of Low Volume Road Design Manuals and update of standard specifications and detailed drawings for three AfCAP member countries in West Africa
Annex B: Workshop Participants – Ghana

S.N.	NAME	POSITION	INSTITUTION	ACCESS TO DRAFT	ATTENDED DAY 1	ATTENDED DAY 2
42	Festus Odametey	CDS Drainage Expert	CDS	YES	YES	
43	Gareth Hearn	CDS Geologist	CDS	YES	YES	YES
44	Hamish Goldie-Scot	CDS Ghana Team Leader	CDS	YES	YES	YES
45	Lucas Ebels	CDS Pavement Engineer	CDS	YES	YES	YES
46	Robert Geddes	CDS Team Leader	CDS	YES	YES	
47	Ron Isaac	CDS Rural Roads Engineer	CDS	YES	YES	O

Annex C. Presentations Made –Sierra Leone

Annex D. Workshop Exercises – Sierra Leone

Annex E. Presentations Made – Ghana

Annex F. Workshop Exercises – Ghana