Africa Community Access Programme

Workshop on Innovations in Road Design

Juba, South Sudan, 4th and 5th August 2011

Workshop Report

1 Workshop Objectives

The primary objective of the workshop was to present recent innovations in the design of low volume roads, with particular reference to the new Low Volume Roads Design Manuals prepared under AFCAP[1] in Ethiopia. A secondary objective was to appraise practitioners in South Sudan of changes that are being made to Ethiopia design manuals and specifications for high volume roads. South Sudan is presently using Ethiopia road design standards from 2002.

2 Participation

The workshop was attended by mainly engineers and technicians from South Sudan and neighbouring countries (Kenya and Ethiopia). The total attendance was 67. Only one participant was female. The participant list is included in Annex A and the profile of the participants is summarised below.

Nationality:			
South Sudan 63%	Foreign 37%		

Education:			
University degree 52%	College Diploma 41%	Secondary School 7%	

Experience in road management, design, construction or maintenance:			
Less than 5 years 37%	5 to 10 years 20%	More than 10 years 43%	

Employment:			
Central government 24%	State government 33%	Consultant 35%	Contractor 9%

3 Venue

The workshop was held at the Star Hotel in Juba. The meeting hall was well suited to the number of participants, many of whom were accommodated at the venue. The hotel provided a computer projector and a good public address system. Some of the sessions were disrupted by a fault in the hotel power supply.

4 Programme

The workshop programme is included in Annex B. The programme was based around technical presentations followed by discussion periods. Participants were given copies of all PowerPoint presentations in electronic form, as well as the draft Ethiopia design manuals for low volume roads.

[1] The Africa Community Access Programme (AFCAP) is a research programme funded by the UK government's Department for International Development (DFID), which is promoting safe and sustainable rural access in Africa. AFCAP supports 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.

5 Discussion Subjects

The following subjects were discussed in some detail following questions from the participants (Q = Question, A = Answer):

1. Q – Is the camber of 7% recommended for gravel roads correct? A - The Ethiopia manuals recommend 7% camber with good gravel materials to ensure that rain water is shed from the carriageway. The camber should be reduced where the wearing course material is highly erodible. (Some participants felt that 7% is too steep, and might be dangerous for road users).

2. Q - Should heavy vehicles be converted to "passenger car units" for the calculation of Annual Average Daily Traffic? A - This is not normal practice, where AADT is simply taken as the average number of motorised vehicles using the road. The Ethiopia manual provides for a large percentage of heavy vehicles by allowing the designer to move up one traffic class for geometric design.

3. Q - Some of the vehicle axle load equivalency factors in the design manual appear high. A - These factors need to be calibrated for local conditions. It was noted that very high axle loads have been measured on the Nimule-Juba road.

4. Q - Should the seal used on the road shoulder be the same as the seal used on the carriageway? A – Due to the lesser trafficking of the shoulder compared with the carriageway, it is advisable to use a higher binder (bitumen) content on the shoulders, where the seal can become brittle more quickly than on the carriageway resulting in ravelling and loss of aggregate.

5. Q - Is super-elevation (adverse camber) needed on low volume roads? A - The Ethiopia manuals allow for super-elevation on all roads except class DC1 (<25 vehicles per day). On bends where adverse camber has been removed the deterioration of the road can be accelerated because rainwater falling on the road has a greater distance to travel. However, adverse camber is dangerous and should be removed for this reason on higher traffic roads.

6. Q - Can a contractor offer an alternative design using the low volume road design approach? A - Clients will normally consider this if there is a cost saving.

7. It is the joint responsibility of consultants and the client to achieve the most costs effective solution in the design of a road.

8. Testing of construction materials on sites was discussed, and the need for a good laboratory on site was emphasised. The difference in results obtained with some BS and AASHTO test methods due to differences in test procedure or equipment was highlighted.

9. A participant indicated interest in community-based road maintenance being researched by AFCAP in Tanzania. There is evidence that communities are prepared to maintain roads, particularly to restore basic access. It is too early to see any results from the Tanzania research now but they will be available next year.

10. Q - The Under-Secretary indicated in his opening address that the GOSS would be paving 3,000km of trunk roads. Where crushed stone is not available for the road base can laterite be used with chemical stabilisation? A – Yes, one of the main purposes of the new Ethiopia standards for low volume roads is to promote the use of locally available materials. Appropriate quality laterite can be used for road bases without chemical stabilisation.

11. Q – Can bitumen emulsion be used for graded aggregate seals? A – Yes, but if the application rate is high the emulsion tends to run off the road surface, especially on slopes. Research in

South Africa and Kenya has shown that it is preferable to mix the emulsion with the aggregate first and apply it as a thin cold premix surfacing.

12. Q – Is pre-coating of aggregate for chip seals recommended? A – Yes, it is, especially where the aggregates are dusty. Where aggregates are not dusty, the adhesion of the bitumen to the aggregate may be a problem, especially with smooth-textured aggregates. In such a case, it is important to carry out an adhesion test on the aggregate to ascertain whether an adhesion agent is required.

13. Q – How is the surface temperature measured for the selection of the appropriate binder? A- With a thermometer placed in a small hole in the road surface with oil in it.

14. Q – How is the application rate for chippings calculated? A – From design charts, but these are not precise due to the irregular shape of chippings. A short trial section should be built on site.

15. Q – Do the new documents provide guidance for surfacings on severe sites? A – Yes, for example guidance is given in the new Ethiopia Pavement Design Manual for the design of asphaltic concrete on climbing lanes and approaches to roundabouts. Modified binders should be considered for difficult sites where surface dressing is used.

16. Research was carried out into bamboo reinforcing of concrete road surfacing in South East Asia. The research showed that the bamboo rots and provides no additional strength to the concrete.

17. It was reported that there is a section of Otta Seal constructed by labour based methods in Juba in the 1980s. The section is still intact.

18. Cobble stones are being used extensively and very successfully for surfacing urban roads in Bujumbura, in Burundi and could be considered for use in South Sudan.

6 Observations

The main observations of the workshop presenters are as follows:

1. The participation in the discussion periods was considerably lower than normally experienced at this type of AFCAP event. This was an indication that the subject matter was new to many of the participants and the presentations possibly too technically complex. Despite feedback from most participants that the presented material was “about right” (see Annex D), it was clear that many did not have sufficient technical background and experience to benefit fully from the knowledge and ideas presented. This was particularly evident amongst participants from the South Sudan States.

2. There was a lot of enthusiasm to learn about new approaches to road design and the workshop achieved greater awareness of these approaches. Many of the participants indicated that they felt the workshop was too short. They were appreciative of the opportunity to learn new concepts and to interact with AFCAP experts.

3. The Ethiopia Low Volume Roads design standards are generally appropriate to South Sudan conditions, but customisation is required. This would need to be followed by a large scale training and awareness programme.

7 Closing Address

In his closing address the Under Secretary (MOTR) made the following comments:

1. The workshop was well attended, with representatives from most of the states, consulting firms, contractors, and from the MTR.

2. The policy of the South Sudan government is to improve road connectivity for the new nation. After completion of the Nimule to Juba road, paved road construction will continue to all other main centres. In particular, reliable road access is needed to the oil areas in the north.

3. AFCAP should organise a review of the Ethiopia documents and propose modifications to make them relevant to South Sudan. The new design manuals should be made available to the states.

8 Next Steps

The next step identified for AFCAP in South Sudan is to establish a group to review the new Ethiopia standards in relation to conditions in South Sudan, customise them and publish them as Government of South Sudan official documents.

It is also evident that the construction of research and demonstration sections using the Low Volume Sealed Roads design approach would be highly beneficial in demonstrating low volume roads design standards. South Sudan has significant deposits of laterite, which though considered "non-conventional" in traditional road design standards, is highly appropriate to the construction of pavement layers, including the base course, for low volume roads. In some cases the laterite can also be screened and used in a graded aggregate seal.

9 Acknowledgements

AFCAP management would like to thank the South Sudan Ministry of Transport and Roads for hosting to the event, and to the Under Secretary for his opening and closing addresses. We are highly appreciative of the work done by Philip Marlow Wai Wai in organising the venue and the participants. We would also like to thank the World Food Programme for supporting the air travel costs of participants from the states, and Louis Berger Group / USAID for releasing Mike Pinard.

ANNEX A: Participant List

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ANNEX B: Programme

Day 1: 4th Aug		Presenter/Facilitator
08:00 – 08:40	Registration	
08:40 – 08:55	Welcome Address	Under Secretary, MOTR
08:55 – 09:00	Workshop objectives and introduction of participants	Rob Geddes (AFCAP Technical Manager)
09:00 – 09:20	Summary of South Sudan Road Sector Programme	P Wai Wai (MOTR)
09:20 – 09:40	Introduction to AFCAP	R Geddes
09:40 – 10:10	Road Classification Systems • Best practice • Ethiopia • South Sudan	Mike Pinard (consultant)
10:10 – 10:45	Tea/Coffee	
10:45 – 12:15	Geometric design of low volume roads • Estimating traffic • Design speed • Influence of terrain • Accommodating NMT and other road safety issues.	J Rolt (TRL)
12:15 – 12.45	Discussion	J Rolt
12:45 -13:45	Lunch	
13:45 – 14:15	Summary of new documentation for the design and construction of low volume roads in Ethiopia (manuals, specs, TORs for consultants, bidding docs)	R Geddes
14:15 – 15:30	Fundamentals of LVR pavement design • Influence of environment versus traffic • Estimating traffic loads • Classification of materials	M Pinard
15:30 – 16:00	Tea/Coffee	
16:00 - 17: 00	Discussion	Geddes, Pinard, Rolt

Day 2: 5th Aug		
8:30 – 9:15	Earth and gravel road design	J Rolt
9:15 – 10:00	Dealing with problem soils	M Pinard
10:00 – 10:30	Discussion	M Pinard and J Rolt
10:30 – 11.00	Tea/Coffee	
11:00 – 12:15	Recent Changes to Ethiopia Design Standards for High Volume Roads • Pavement and bituminous mix design • Geometric design • Other	J Rolt
12:15 – 12:45	Drainage design for LVRs	R Geddes
12:45 - 13:45	Lunch	
13:45 – 14:30	Surfacings for LVRs:	M Pinard
14:30 – 15:15	Design of Otta seals and Chip seals	M Pinard and J Rolt
15:15 -15:45	Tea/Coffee	
15:45 – 16:45	Discussion and Resolutions	R Geddes
16:45 – 17:00	Closure of workshop	Under Secretary, MOTR

ANNEX C: Questionnaire

1. Your nationality:

   Sudan Foreign

2. Your education:

   University degree College Diploma Secondary School

3. Your experience in road management, design, construction or maintenance:

   Less than 5 years 5 to 10 years More than 10 years

4. Your Employment

   Central government State government Consultant Contractor

5. Was this 2 day workshop:

   Too short Too long About the right length

6. Were the presentations:

   Too short Too long About the right length

7. Were the discussion periods:

   Too short Too long About the right length

8. Was the presented material:

   Too complicated Too simple About right

9. What did you like about the workshop?

   _____

10. What did you dislike about the workshop?

    _____

ANNEX D: Participant Feedback

The feedback from the participants is summarised in below.

Workshop length	Too short	54%
	Too long	2%
	About right	43%

Presentation length	Too short	30%
	Too long	7%
	About right	61%

Discussion periods	Too short	41%
	Too long	7%
	About right	52%

Presented material	Too complicated	13%
	Too simple	13%
	About right	74%

Participants Liked:

Comprehensive coverage of material	13%
Interesting arguments / new material	13%
Learnt a lot	11%
Revived university knowledge	7%
Good presenters and presentations	20%
Meeting experts and sharing knowledge	7%
Discussion on Problem Soils	7%
Discussion on Otta seals and other seals	15%
Discussion on drainage design	2%
Discussion on Road Classification	2%
Discussion on Earth and Gravel Road design	4%

Participants Disliked:

Nothing	17%
Time too short	28%
Power cuts during presentations	13%
Use of cell phones by participants	2%
Lack of participation	4%
Inadequate allowances	7%
No name tags	2%
No practical examples of use of pavement design charts	2%
No handouts (especially copies of Ethiopia manuals)	4%