TAN008

Design, Construction and Monitoring of Demonstration Sites for District Road Improvement in Tanzania to the Prime Minister's Office – Regional Administration and Local Government (PMO-RALG) under the African Community Access Programme (AFCAP)

Workshop Report

May 2013

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DESIGN, CONSTRUCTION AND MONITORING OF DEMONSTRATION SITES FOR DISTRICT ROAD IMPROVEMENT IN TANZANIA TO THE PRIME MINISTER'S OFFICE – REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT (PMO-RALG) UNDER THE AFRICAN COMMUNITY ACCESS PROGRAMME (AFCAP)
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1. DAY 1

Workshop 1

Location: Travellers Lodge, Bagamoyo

6th May 2013

The Project Director opened the workshop and briefly explained the main intentions were to obtain feedback on the two projects undertaken in Bagamoyo and Siha. The workshop was intentionally planned as informal to encourage such feedback. Following a brief explanation on AFCAP the group commenced the site visit of the road in Bago, some 70km from the workshop, in the Bagamoyo District.

Table 1-1 summarises the trial section on the Bago road. The visit included a number of stops at each surface option, with the exception of the double surface dressing option due to intense rain at the time the visit passed the section. Discussions were varied with the following comprising a brief summary

1.1 General Site Observations

Traffic has been measured at about 20 of 4-wheeled vehicles per day (no 3-axled vehicles) but the number of motorcycles is generally over 300 per day and sometimes over 500. This is becoming a common situation in Tanzania and provisions for large numbers of motorcycles need to be included in the geometric and surfacing designs of LVR. For example, surfacings with loose stones may be dangerous and very high roughness surfacings may be detrimental. The growth rate of traffic also appears to be very high (20%+).

Table 1-2: includes typical photographs of the various sections and a brief narrative.

In addition to the surfacing there were several other points worth noting:

1.1.1 Concrete Drifts

These appeared well constructed, however, it was thought that the pillars upstream could be closer to assist pedestrians to cross during wet weather where they can be used as stepping stones.

1.1.2 Concrete Bridge

Not constructed under AFCAP. It was noticed that the reinforced concrete hazard bollard had been hit. It suggests that the bridge is too narrow. It was also noted that warnings indicating the bridge could be made more prominent for motorists. Eg. introducing rumble strips on bridge approaches. There were no warning signs present.

1.1.3 Soft Spot

There was one soft area approximately 3m in length and 5 m width in an area of black cotton soil. The vehicle had some problems getting through.

Table 1-1: The 14 Trial Sections at Bago

Section No	Chainage		Surface Type	Notes
	Start	End		
1	0.000	0.200	Single Otta + Sand Seal	Drains looked excellent, but there appeared to be some minor potholes forming.
2	5.340	5.520	Hand-packed stone	The weather prohibited close inspection. The road was very rough.
3	5.560	6.080	Concrete Strips (100mm thick) reinforced	There are two types of concrete strips, reinforced and unreinforced. There is no noticeable difference between the two types of concrete strips at this stage. The gravel shoulders were intact with very few areas where there was a step between the gravel level and concrete level.
4	6.080	7.750	Geocells filled with concrete (75mm)	This surface was of particular interest as most had not seen this implemented. The cracks on the surface generally followed the shapes of the geocells. However there were some isolated longitudinal cracks. The surface was generally in good conditions and the colour (and therefore the concrete mix) varied at cold joint locations, suggesting variations in workmanship.
5	8.000	8.240	Double Surface Dressing (stone sizes 14mm & 6mm)	This was not inspected, but the ride quality was excellent with no noticeable defects
6	8.320	8.820	Geocells	See above
7	9.980	10.670	Concrete strips (100mm)	See above
8	11.200	11.400	Double Sand Seal	This appeared to be in excellent condition. The stone pitched side drains alongside the road were also in good condition. The road passed through a number of settlements and the community had taken it upon themselves to construct crude ramps in order to slow the motorbikes (Boda Boda). The surface was soft during hot weather and observation made by the community.
9	12.200	12.580	Gravel (150mm)	
10	16.240	17.100	Concrete strips (100mm)	See above
11	18.480	18.740	Concrete strips (100mm)	See above
12	19.000	19.200	Gravel 150mm	
13	19.400	20.040	Gravel 150mm	
14	20.040	20.200	Slurry Seal	The section is not performing well. Both a lime and a cement slurry were used with the lime performing noticeably worse than the cement. There were excessive over-sized stone in the gravel base layer. Discussions took place as to the suitability of a slurry seal applied to a gravel base. The construction quality is poor and it is recommended that this be eliminated from the comparisons because it is atypical.

Table 1-2:

Slurry Seal: Left side is Lime Slurry, the Right side is Cement Slurry. Latter performing better, but neither performing well. Does not appear to be appropriate solution, possibly due to lack of construction		Geocells: some minor cracks and spalling, but overall performance is good	
Concrete Strips with concrete intermittent ribs. The gravel shoulders are performing well		Narrow section due to bridge – note safety reinforced concrete bollards. This could be too narrow	

Sand Seal well-constructed (and measures taken by Villagers to reduce speed) Softening at high temperatures was the feedback from the community		Significant lengths of Unpaved Road Gravel is performing well (but some maintenance is required as can be seen)	

Following the site visit, a list of topics for discussion was agreed as follows:-

- Overall impression
- Road Width
- Surfacing options (pros & cons)
- Pavement Monitoring
- Road Maintenance
- Comparative costs of options
- Drainage
- Pavement Design
- Alignment
- Transitions
- Quality of workmanship
- Road Safety
  - Safety of surfacings
  - Safety at water crossing
  - Safety through villages

The remit of this project is to ensure that the outputs of the assignment will include design guides and specification for a range of pavement designs and surfacings for low volume rural roads in Tanzania. However, a number of topics listed above are not considered part of the assignment, but there are important considerations that are linked and worthy of capturing during the workshop.

1.2 Overall impression

Ms Elina Kayanda commented that the project was a success and she thanked AFCAP and the Project Director. She further commented that the costs of the surfacings were reachable with the exception of the Geocells which was border line. She was keen to have some of these ideas adopted and from this point of view considers the project very useful.

1.2.1 Road width

The considerations required to specify a suitable width for low volume roads was a subject of considerable discussion with a number of varying views and preferences.

After a lengthy discussion the following was agreed:

Table 1-3: Road Widths

ADT (mid life)	No of Lanes	Lane width	Shoulder width	Alignment	No of passing Bays
<75	1	3.5	0.5	Non engineered	2 per km1

76 to 150	1	4.5	0.5	Non engineered	3 per km1
151 to 300	2	5.5	0.5	Engineered	None Required

Notes: Passing bays may need to be increased particularly on hilly roads to minimise accidents at crests.

It was agreed that the passing bays on the demonstration project should be more prominent. It was also thought that additional bays can be provided as traffic increases.

The traffic growth rates were discussed and it was agreed that we should cater for the 10 year traffic. It was also agreed that a 60:40 split should be applied for the direction of traffic.

Further consideration should be given to the effect of traffic growth on the network as a whole. Changes to surrounding roads can alter traffic behaviour.

Discussions were extensive on the safety aspects of providing 3.5m single lane carriageway and whether it would be more cost effective in terms of whole life costs to provide a 2-lane carriageway from the onset. This would mean less roads and therefore some places would have their economic growth restricted. It would be more effective if the roads were re-assessed for upgrades as demand rises thus providing a stage construction solution.

Consideration should also be given to locating the road in the central reserve with the foresight of enabling cost effective widening in the future. This could be symmetrical or asymmetric widening and the road features could dictate this. It may therefore, in some cases, be prudent to ensure the centreline for the road was offset from the centreline of the road reserve to facilitate future widening and making as much use of the existing subgrade as possible.

An important aspect to consider when upgrading to a 2-lane carriageway is the requirement to provide an engineered alignment which could result in a complete reconstruction. This is an important consideration as traffic speed will considerably increase with the increase in width. Safety will therefore be an added consideration when considering upgrading to increase capacity.

Drainage was discussed and it was agreed that hydrology and hydraulic designs should be undertaken to ensure resilience against potential flooding and scour. Suitably sized culverts with adequate spacings should then be provided. In areas of cut, subsurface drainage should be provided, located beneath open channel drains on either side.

It was agreed that reducing the cross fall to between 3% and 2.5% to facilitate the use of emulsions would be advantageous. Although this is flatter than a standard primary road, the reduced width will result in less water on the road, and the use of emulsions will enhance buildability, particularly for smaller contractors. However, this would also affect the longitudinal gradient and it may be that the increased spray rate required for emulsions and the restrictive nature result in the emulsion being prohibitive. Nevertheless, emulsions should be a consideration in the appropriate places.

2. DAY 2

An initial discussion took place on what should be included in a Low Volume Roads Manual for Tanzania. It was agreed that it was important to understand the context within which this AFCAP task fits, but that it is important to focus on the specifications for the range of pavement designs and surfacings.

2.1 Surfacing options

Surfacing options were selected based on previous experience and discussions with the AFCAP team (see Table 1)

Clay bricks were not used as previous experience has shown this option to perform inadequately. Single Surface Dressing with Sand Seal; Cape seal; and Cold Mix Asphalt were not used. The final report should include a discussion on the reasons for this.

2.2 General comments

It was noted from the comments that were made in the workshop that some participants were considering only the lowest class of road (<75 vpd). However, the class of LVRs also includes traffic in the range 75-150 vpd and possibly 150-300 vpd.

The roads should be designed for trucks up to 10 tonne GVW.

During the monitoring and maintenance stages failures that may occur should be recorded and where possible the reasons identified. For example, this could be due to a blocked drain or hand packed stones being taken and would not be as a result of inappropriate materials being used or poor specification.

The District Council stated that Tanzania has used hand-packed stone before with really good results. Although in this project we had some problems because it was used in flood areas. However, it was the easiest to repair. Since the repairs, the DE has cleared obstructions downstream of the water crossing and there should be less flooding in the near future.

2.3 Cost Comparisons

Table 2-1: Pavement Costs

Surface Type	Cost $ per km
Gravel Pavement - Flat	19,822
Gravel Pavement - Hilly	19,822
Concrete Strips (Unreinforced)	62,877*
Geocells - 75 mm	75,168
Hand Packed Stone	77,034
Concrete Strips (Reinforced)	77,041*
Slurry Seal	77,632
Double Sand Seal	89,147
Single Otta Seal with Sand Seal	95,634
Double Surface Dressing	109,409

*Concrete costs only

Some questions were raised about the costs in Table 3.

The costs in the Table are the engineer's costs. How did the engineer's estimate compare with the construction costs?

There was little comparison as the contractor's rates were erratic and inconsistent.

Was the cost of Geocell all inclusive? Yes

2.4 Whole life costs

It was emphasised that surfacing choice depends on whole life costs. For LVRs it is normal to include only construction and maintenance costs but user costs can be important. It is differences in user costs for different surfaces over the life of the road that normally enter VOC economic calculations but these are usually small when traffic is low. However, the cost of lost benefits when a road is impassable can be substantial especially if road closure is for weeks at a time. Such costs should be included to help justify all-weather access solutions.

The whole life costing was discussed and it was questioned as to whether a 20 year life was appropriate or whether this should be reduced to 10 years and how to calculate the residual life (salvage).

A discussion took place on how long a gravel wearing course would be expected to last, and the Districts were asked this question. Unfortunately there was no conclusive answer. It was considered that in flat terrain about 6 years would be expected and in steep terrain less than 3 but this depends on the quality of the gravel, rainfall and traffic. This was another example of the participants considering only the lowest levels of traffic.

The Whole Life Costs should also consider delays in maintenance and costs (lost benefits) caused by inaccessibility.

Some surfacings require much less maintenance than others and therefore realistic estimates of the likely maintenance is vital in the calculation of whole life costs and the selection of the best choice surfacing. A maintenance and no maintenance scenario should be used in the calculations.

In choosing a surfacing, care should be taken in analysing the whole life costs to ensure that comparisons are on a like for like basis. For example it is wrong to compare the performance of hand-packed stone in a flood prone area with a double surface dressing in a dry, flat area.

The life cycle costs used assume good workmanship and reasonable maintenance.

A table of assumed life expectancy and maintenance interventions is required. The following suggestions were made:-

Table 2-2: Estimated Maintenance Requirements

Surfacing Type	Routine Maintenance	Other Interventions
Otta Seal	0.5% of surface area every year	Reseal every 10 years
Gravel Flat (<3%)	Grade every year	Regravel every 5 years
Gravel Steep (3-6%)	Regravel every 6 months	None
Geocells	Replace 3% of surface area every year	None
Concrete Strips	Re-gravel adjacent to the strips each year	None
Hand-packed stone	Replace 6% of surface area every year	Differs on expansive clays
Double Sand Seal	1% every year	Reseal after 6 years
Slurry Seal	1% every year	Reseal after 6 years
Double Surface Dressing	0.5% every year	Single seal after 10 years

These are estimates based on experience and knowledge of how surfacings that are generally used behave during their design life. There are a number of gaps due to unknowns, and through further monitoring and observation these can be filled.

It is important to note that comparing different surfacings on these pilot schemes may not be a fair comparison as they are subjected to different environmental conditions eg. BCS or Flooding etc. One may therefore not be comparing like with like.

The intention is to have some 10 years of monitoring. In the analysis of performance it will be important to ensure that the construction issues do not mask the underlying or potential performance of the different surfacings sections.

One of the key monitoring measurements was Roughness and we are starting off with values of around 10 IRI. There was some discussion as to whether this was worth monitoring. A paper discussing the required monitoring procedures is to be written and there was more discussion of this later in the week.

Mike Pinard showed the SATCC Guidelines Table of typical service lives for the different surfacings but it was pointed out that the best surfacings are often used for the most severe sites (steep gradients, flood prone areas, high rainfall areas, more heavily trafficked area, hence their service lives may be shorter. Reiterated: It is important to compare like with like and this should be borne in mind when compiling a Table illustrating the pros and cons and potential service lives of each option.

2.5 Selection of Sufacing

A number of issues were discussed:-

- High roughness and VOC will not depend on the type of surfacing. After 10 years, for example, the lost benefit when the road is impassable will be huge.

- Increase in motorcycles could affect the choice of surfacing. This could complicate the estimation of the whole life cost.
- The roughness as a result of the oversized material in the base could be overcome by crushing, but the cost could be prohibitive.
- The choice of surfacing depends on other factors as well as whole life costs. A table was suggested that identified the pros and cons of each surfacing.

It was agreed that some surfacings were more foolproof than others. There are large variations in contractor capabilities hence this can be taken partly into account when selecting a surfacing. Also the necessary quality control activities will vary with surfacing. Hence if testing facilities are poor or not reliable, a more 'foolproof' choice might be chosen.

2.6 Emulsions

Favoured for environmental reasons but it was stated that they cannot be used if the gradient or camber exceeds 3 or 4% hence camber needs to be decreased. This is a dangerous approach, especially for LB construction because the possibility of low spots and water ponding are increased considerably.

2.7 Road Safety

Presentation by Amend.

The following are the highlights of the presentation:-

- Road Traffic Injuries are increasing following the improvements
- Community based road safety measures (training, education, materials) have not been effective
- Safety should be a critical consideration in design and construction of rural roads. Motorcycle safety should be considered. (perhaps under its own chapter as behaviour is so different from other road users)
- Cause and frequency of accidents needs more research
- Safety measures need to be proportionate to the use of the road
- Innovative solutions such as small gaps in rumble strips to ensure motorcycle rider slows down to track the tyres through the gap and avoid the discomfort of the rumble strips.
- Behaviour change is required and this can only be through regulation and enforcement
- Boda Bodas were identified as a high risk to themselves and others including other road users and communities.
- A number of riders are young and tend to drive too fast and carry more than one passenger at a time. It was also observed that some do not wear helmets and, in some cases, do not wear shoes.

The Amend study involved obtaining accident data (primarily accident numbers) for the roads before and after a sample of 100 drivers were given training. This training included riding skills, but was theoretical with little practical. The pass rate was 100%. This is a cause for concern about the training and also the test itself:

- It is normal practice to bribe an official to obtain a driving licence.
- The study did not, unfortunately, identify the primary causes of accidents and therefore could not help in the design of the roads.
- Riders appear to travel faster when they are on their own because they are looking for fare paying passengers.

- Concrete strip roads were considered to be relatively unsafe because of the likelihood of losing control when driving over an uneven edge between the concrete and adjacent gravel fill. This can happen regularly when passing an oncoming vehicle (Boda Bodas do not use passing bays).
- The speed of the traffic, particularly the Boda Bodas, on the sand seal through a community area, has prompted the community to take matters into their own hands. They constructed 3 speed ramps.

It was agreed that safety should be considered for LVRs and details should be included in a future manual for Tanzania. It was also accepted that more should be spent on safety matters for roads with traffic levels of greater than 300 vpd.

The safety presentation concentrated on accident frequency and, especially, accidents involving motorcycles. It was a little disappointing in that, at this stage, the researchers had not discovered much about the causes of the accidents and therefore could not advise on road design aspects that could minimise them. Nevertheless high speed was considered the crux of the matter and the discussion centred on speed reducing features. Leaving local people to build trenches in their new road do achieve this (as had happened at one location) was not a recommended strategy.

3. DAY 4

Workshop 2

Location: Protea Aishi Hotel, Hai District

9th May 2013

The workshop commenced with a site visit in the morning, followed by a meeting in the afternoon. The sections of road are summarised in the following Table 3-1: Details of the Trial Sections at Siha

Table 3-1: Details of the Trial Sections at Siha

Section No	Chainage		Surface Type	Notes
	Start	End		
1	0.000	0.200	Concrete Paving Blocks	Well constructed, including the speed ramps.
2	1.360	1.500	Unreinforced Concrete Slab (100mm)	Some premature cracking and an isolated area where ground water was seeping up through a crack. (the road was in cutting)
3	1.960	2.180	Concrete-filled Geocells (75mm)	Generally visually ok, but some longitudinal cracks were appearing. The texture was rough, but considered a good thing for traction
4	2.180	2.580	Unreinforced concrete slab (75mm)	Rough texture some cracking
5	2.580	2.780	Gravel	No comment
6	2.780	3.640	Concrete Strips (100mm)	Some longitudinal cracks and it was noted that an attempt was made to seal them
7	4.340	4.540	Double Surface Dressing	Looked very good. Some clearing of loose stones is recommended
8	4.540	4.780	Concrete Strips (100mm)	Some longitudinal cracks
9	4.780	5.000	Unreinforced Concrete Slab (100mm)	Longitudinal cracks 2 No approximately in the wheel paths
10	5.000	6.100	Concrete Strips (100mm)	Some longitudinal cracks
11	6.340	6.620	Unreinforced Concrete Slab (100mm)	Some cracks, but not as extensive as earlier sections
12	7.720	8.260	Concrete Strips (100mm)	Ok
13	9.670	9.900	Unreinforced Concrete Slab (75mm)	Some cracks, but not as extensive as earlier sections
14	10.100	10.300	Concrete Strips (100mm)	Some cracks, but not as extensive as earlier sections
15	10.680	11.200	Concrete Strips (100mm)	Some cracks, but not as extensive as earlier sections
16	11.620	11.820	Bituminous Penetration Macadam	Good condition
17	11.820	12.120	Lightly Reinforced Concrete Slab (100mm)	Some cracks, but not as extensive as earlier sections
18	12.280	12.560	Lightly Reinforced Concrete Slab (75mm)	Some cracks, but not as extensive as earlier sections
19	12.640	13.070	Lightly Reinforced Concrete Slab (100mm)	Some cracks, but not as extensive as earlier sections
20	13.070	13.480	Gravel	Good condition

3.1 General Observations

An attempt was made to list all the surfacings and to classify them in terms of some specific characteristics. These characteristics included Ease of Construction, Ease of Maintenance, Safety of Road Users, Safety of Others, and Durability.

It was soon apparent that this was an impossible task. Ease of construction and maintenance, for example, vary greatly depending on whether the contractor has the proper equipment, the terrain and many other things. Some surfacings would never be used except in difficult conditions, for example, where their normally high durability might not be apparent. It was concluded that a much more comprehensive multi-dimensional chart is required to properly compare surfacings. Such a chart has been produced on other projects and may need to be edited for use in Tanzania.

Road safety of alternative surfacings was discussed and it was agreed that surface friction and geometry were influential and should therefore be a consideration in LVR design.

In many areas the necessary drainage ditches were missing or inadequate but it was reported that the contractor was still building ditches. In one location the drainage was both over-designed, incorrectly designed and potentially dangerous to road users.

3.2 Condition of Surfaces

In general the surfacing's were in good shape.

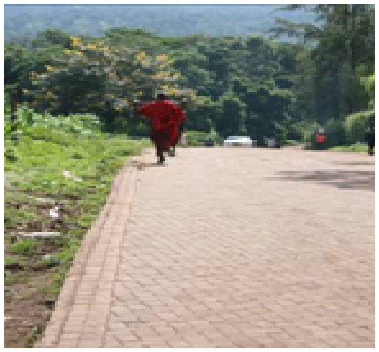
The roughness of the concrete sections was high and deliberate because of the very steep sections and the need to promote water run-off and high friction for safety.

Some cracks were observed on the concrete sections, both slab and strip. Various reasons for this were suggested and it was recommended that Roughton try to establish this before their contract ends:

- Poor quality of concrete
- Inadequate thickness. This could be caused by a poorly shaped sub-base underneath which could easily lead to thin concrete especially on sections that have high and variable camber and especially at the outside edges. Concrete could easily have been forced towards the centre line to ensure good camber leaving the edges too thin.
- Heavy vehicles using the road too soon, before the concrete has gained sufficient strength

Test would typically include taking concrete cores and establishing content and final strengths.

3-1

Block Paving – Good Condition		Concrete Strips – sealed crack	
Concrete slab – Note drainage channel can be used as overrun		Drainage both sides – nowhere for pedestrians to go	
Concrete Geocells – Rough Texture		Soft ground – Potential for future spot improvement	
Concrete Slab – longitudinal crack		Penetration Macadam – Good Condition	

3.2.1 Scour checks on the concrete strips

The chevron shaped concrete scour checks inserted between the two strips on the concrete strip roads designed to prevent water flow in the gravel between the strips by diverting water across the strips to the side drains were placed the wrong way around and therefore concentrated the water rather than dispersed it.

3.2.2 Monitoring

Concern was expressed about the use of the full suite of characteristics that could be monitored, many of which do not change very quickly on LVRs, and the frequency of monitoring.

It was also pointed out that only a small percentage of the road length or surface area of a road needs to deteriorate quickly for the road to be of an unacceptable standard and therefore measuring properties at predetermined chainages might easily give an entirely false impression of the comparative lives of the different sections. It was agreed that a more rational approach to monitoring is required.

A request was made to ensure there is good team work between the consultants and the DEs to ensure continuation of expertise. In addition it was felt that the monitoring period of 2 years was too short for surfacings that are designed to last up to 10 years and more. A period of monitoring of at least 4 years was proposed.

The District Engineers were asked if they considered they would have sufficient capacity to undertake monitoring after the consultant has left. This raised an issue that they did not feel the consultant had involved them sufficiently in the process and there has been little feedback of the monitoring that has been going on. They further stated that they do not have the equipment to undertake monitoring and they are short of staff.

A question was raised as to whether it was necessary to monitor Roughness and pavement strength using DCPs. It was thought that profile and rut depths as well as identifying failure modes were the key monitoring indicators for performance. However, some believed that it would be prudent to have more data than you need rather than regretting not taking certain readings. This was therefore inconclusive. However it was agreed that following a number of such rounds of monitoring measurements, including visual assessments of road condition, there can be more focus on data that will be more meaningful.

It would be useful to have records of all the maintenance works that are carried out on the roads as this can provide useful insights into what is happening.

3.2.3 Preferences for Surfacing Type

An attempt was made to rank all the surfacing types. A discussion took place on whether the ranking was applied in a consistent manner. The best surfacings are often used for the most severe sites (steep gradients, flood prone areas, high rainfall areas, more heavily trafficked area, hence their service lives may be shorter. It is important to compare like with like and this should be borne in mind when compiling a Table illustrating the pros and cons and potential service lives of each option. For this reason it proved impossible to rank all the options. Instead, to obtain an idea of which surfacings are preferred by participants a vote was held. Two questions were asked:

1. What surface is your preferred choice in flat terrain?
2. What surface is your preferred choice in steep terrain?

Unfortunately this was not tied into different traffic levels so it is assumed that a road carrying more than 25ADT and less than 200ADT with lots of motorcycles is the road that participants had in mind. The result of the ballot is shown below:

Table 3-2: Preferred Surface Types

Pavement Type	Vote %	
	Steep	Flat
Concrete Strips	10	36
Double Surface Dressing		36
Unreinforced Concrete Slab (75mm)	60	
Flexible Geocells (75mm)	10	7
Unreinforced Concrete Slab (100mm)		
Concrete Paving Blocks		14
Lightly Reinforced Concrete Slab (75mm)		
Bituminous Penetration Macadam	10	
Lightly Reinforced Concrete Slab (100mm)		
Gravel Pavement - Flat		
Gravel Pavement - Hilly		
Concrete Strips (Unreinforced)		
Geocells - 75 mm		
Hand Packed Stone	10	
Concrete Strips (Reinforced)		
Slurry Seal		
Double Sand Seal		7
Single Otta Seal with Sand Seal		
Double Surface Dressing		

It was interesting to note that, for flat terrain, the two District Engineers had a preference for concrete strips, with the proviso that the width was increased to 4.5m including 0.5m shoulders. In hilly areas, their preference was lightly reinforced concrete slabs.

There are certain locations where particular options are preferred, such as the use of concrete blocks in the vicinity of junctions where heavy turning movements are envisaged.

3.2.4 The DCP Design Method

Mike Pinard provided a presentation on the Malawi LVR rehabilitation design method based on the DCP/DN approach developed in RSA.

3.2.5 General Discussions

The SEACAP Lao examples were presented by Simon Gillett which showed very similar surfacings, but which are now 5 to 6 years older. With the exception of the single sand seal, they were generally in good condition.

3.2.6 Drainage

It was noted that, on sloping ground, drainage does not have to be provided on both sides of the road. Shallow lined V drains should be considered as this could allow a vehicle to enter to allow capacity for passing and is much safer than the lined rectangular cross section. Subsurface drainage in cuttings should be considered.

A question was asked on the spray rates and whether the contractors were able to achieve the onerous +-5%. Apparently this was achieved.

AFCAP has been working on procuring laboratory and some monitoring equipment for Tanzania and hopefully this will be available in the near future.

The AFCAP website contains all the reports submitted to date.

There is a District Engineer's Conference taking place in July 2013 in Arusha and there was some discussion as to whether these roads should be presented. However, it was agreed that this would not be an effective forum for an extensive presentation and discussion, but that a brief summary of the different surfaces and their performances to date could be beneficial. The presentation would need to be reviewed by the PMO RALG office beforehand. This could ultimately lead to the need to arrange a separate conference should the conference deem it necessary.

3.3 In Closing

It was generally agreed that the workshop was beneficial as it raised awareness of the advantages Low Volume Roads offer to Tanzania and the beneficial work that AFCAP are undertaking to meet community needs of providing cost effective reliable access.

4. ATTENDEES

No	Bagamoya 6 May 2013	Siha 9 May 2013	Name	E-Mail Address	Organisation
1	Yes	No	Ally Mwinchande	Ally.mwinchande@eeas.europa.eu	EU-TZ
2	Yes	Yes	Dawit Assoke	Dawit.assess@smec.com	SMEC
3	Yes	Yes	Deepani Jinadasa	Djinadasa@amend.org	AMEND
4	Yes	Yes	Elina Kayanda	elikayanda@yahoo.co.uk	PMO RALG
5	Yes	Yes	Emmanuel Wansibho Raphael	ewansirap@yahoo.co.uk	Ministry of Works TZ ATTI-Mbeya
6	Yes	No	Fabrizio Moroni	Fabrizio.moroni@eeas.europa.eu	European Union
7	Yes	Yes	Gilbert Mwoga	gmwoga@yahoo.com	PMO RALG - Dodoma
8	No	Yes	Ibrahim Shemangale	ibryos@yahoo.com	RAVJI Construction Ltd
9	No	Yes	Joseph.O Haule	jhaule@raha.com	RFB
10	Yes	Yes	John Jarvis	John.jarvis@smec.com	SMEC
11	Yes	Yes	John Rolt	jrolt@trl.co.uk	TRL
12	Yes	Yes	Kenneth Mukura	kmukura@yahoo.com	TRL
13	No	Yes	Mehel Sampat	moshi@ravji.co.tz	Ravji Construction Ltd
14	No	Yes	Meleck Silaa	mysilaa@yahoo.com	Siha District Council
15	Yes	Yes	Mike Pinard	mipinard@global.bw	Roughton International
16	Yes	Yes	Nkululeko Leta	Nkululeko.leta@gmail.com	AFCAP
17	No	Yes	Okuli Tiraufoo	tiraufoo@gmail.com	Regional Secretariat - Kilimanjaro
18	Yes	Yes	Ramsey Neseyif	Ramsey.neseyif@roughton.com	Roughton International
19	Yes	Yes	Rob Geddes	rgeddes@africaonline.co.za	AFCAP
20	Yes	Yes	Samson Kalesi	Sam_kalesi@yahoo.com	Bagamoyo District Council
21	Yes	Yes	Simon Gillett	Simon.gillett@roughton.com	Roughton International
22	Yes	No	Tom Bishop	tbishop@amend.org	AMEND
23	Yes	Yes	Victor Rogers	Victor.rogers@roughton.com	Roughton International