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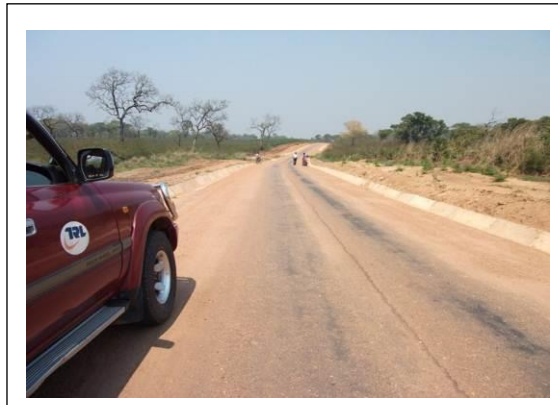
Manual of Work Norms and Specifications for Roads in Mozambique

Regional Dissemination Workshops Report

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May 2014

CONTRACT REF NO. AFCAP/MOZ/001/H



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This project was funded by the Africa Community Access Programme (AFCAP) which promotes safe and sustainable access to markets, healthcare, education, employment and social and political networks for rural communities in Africa.

Launched in June 2008 and managed by Crown Agents, the five year-long, UK government (DFID) funded project, supports research and knowledge sharing between participating countries to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources.

The programme is currently active in Ethiopia, Kenya, Ghana, Malawi, Mozambique, Tanzania, Zambia, South Africa, Democratic Republic of Congo and South Sudan and is developing relationships with a number of other countries and regional organisations across Africa.

This material has been funded by UKaid from the Department for International Development, however the views expressed do not necessarily reflect the department's or the managing agent's official policies.

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Report summary

This report covers the proceedings of the Dissemination Workshops for the Draft Manual for Low Volume Roads in Mozambique and the Work Norms Manual (Normas). The first regional workshop was held at Hotel Afrin in Maputo and the second regional workshop was held at Milenio Hotel in Nampula.

Regional Workshop (Southern), Maputo 23 – 25 April 2014

The workshop was attended by 90 participants from different stakeholders.

1. ANE Head Office and Provincial Delegations (Maputo, Gaza, Inhambane, Sofala and Manica Provinces).
2. District Engineers (Maputo, Gaza, Inhambane, Sofala and Manica Provinces).
3. The Road Fund.
4. Laboritorio Engenharia de Mocambique (LEM)
5. Chimoio Training Centre.
6. Provincial Consultants
7. Contractors
8. Contractors Association
9. AFCAP.
10. LNEC from Portugal.
11. TRL.

The workshop was officially opened by the General Director of ANE. The Director of Maintenance chaired the workshop proceedings and the Head of Maintenance was the main facilitator.

Regional Workshop (Northern), Nampula , 28-30 April 2014

The workshop was attended by approximately 70 participants representing several organisations.

1. ANE Head Office and Provincial Delegations (Maputo, Gaza, Inhambane, Sofala and Manica Provinces).
2. District Engineers (Maputo, Gaza, Inhambane, Sofala and Manica Provinces).

3. Provincial Consultants
4. Contractors
5. TRL.

The workshop was officially opened by the Director of Maintenance and chaired by the Provincial Delegate of ANE Nampula. The Head of Maintenance facilitated the workshop.

This workshop report contains briefs of presentations, discussions and resolutions made on chapters and the different Series in the Normas and sections of the draft Planning and Design Manual. Presentations were made on each of the Series in the Work Norms Manual including Preliminaries and General, Drainage, Earthworks, Surfacing, Structures, Quality Control, and Maintenance. The main sections of the Draft Manual were also presented and they included Planning, Drainage Design, Geometric Design, Pavement Design and Design of Surfacing.

There were a lot of lively and open discussions and contributions. The presentations also included issues of concern or challenges some of which have a bearing on the drafting of the manual. The report also has a column on resolutions and agreements made during the workshops including the changes that should be made to the draft manuals.

Updating of the Mozambique Manuals – Dissemination Workshops Report

May 2014

Present

ANE Directorate and Staff and invited stakeholders

Maputo Workshop

Eng. Atanásio Mugunhe	General Director
Eng. Silvestre Elias	Director of Maintenance
Eng. Miguel Coanai	Director of Planning
Eng. Aderito Guilamba	Director of Projects
Eng. Luis Fernandes	Head of Maintenance/ Facilitator
ANE-DIMAN	Staff
ANE - DP ANE- Maputo	Staff
ANE-DIPRO	Staff
ANE-DIPLA	Staff
Provincial Consultants	
District Engineers	
Contractors	
Road Fund	
LEM	

Nampula Workshop

Eng. Silvestre Elias	Director of Maintenance
Eng. Luis Fernandes	Head of Maintenance/Workshop Facilitator
ANE-DIMAN	Staff
ANE - DP ANE- Maputo	Staff
ANE-DIPRO	Staff
ANE-DIPLA	Staff
Provincial Consultants	

District Engineers	
Contractors	

TRL Project Team

Kenneth Mukura	Project Manager/Author
Dr. John Rolt	Senior Researcher/Author
Mike Pinard	Low Volume Roads Specialist

List of participants is attached.

Objectives of the Workshop

1. To disseminate the contents of the manuals.
2. To discuss the technical coverage of the manual and challenges being faced.
3. To obtain ANE and stakeholders inputs necessary to guide the authors.

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1. Proceedings

Welcome remarks by the Director of Maintenance, Engineer Silvestre Elias	Comments and Resolutions
<p>The Director of Maintenance welcomed all participants who included ANE Head Office Staff, Provincial Delegations, District Engineers, Contractors, Consultants, Representatives of Contractors and Consultants Associations, Laboratorio de Engenharia de Mocambique (LEM), Road Fund Staff, External Consultants TRL, and invited consultant LNEC. He outlined the purpose and expectations of the workshop.</p> <ul style="list-style-type: none"> • The task of reviewing manuals is a serious undertaking and consultative feedback is required from all participants. • He urged participants to stay focussed and feel free to contribute and air their views. 	
Opening Address by the General Director, Eng. Atanacio Mugunhe	
<p>The General Director highlighted the challenges that ANE is facing and set out ANE's expectations and how the project for updating manuals fits in with Government Policy. The main points were:-</p> <ul style="list-style-type: none"> • ANE is facing problems in providing sustainable access to many areas in Mozambique. • Climate change is a major problem with serious flooding caused by increasing intensity of rainfall. • Providing mobility and access for much of the population, especially in rural areas, is a major challenge. • Resources are limited and it is necessary to use the available resources effectively through innovative approaches. • The manuals that are being developed provide the necessary tools for the road sector, including the districts. • The experts should provide best practice to help the practitioners deliver good quality works and within budgets. • There is need for increased use of unconventional materials (the use of the term marginal materials should be avoided because in Portuguese it refers to bad and unsuitable materials). • Government policy is to provide rural mobility in order to reduce poverty. • The roads should be appropriate for the purpose. • The intention is to unlock Mozambique's potential, particularly considering that the country is rich in agriculture. 	

<p>Brief from AFCAP by Engineer Nkululeko Leta</p>	
<p>The AFCAP Technical Manager provided an insight into the Programme, the activities, coverage, operational methodologies, future plans and expectations from the dissemination workshops. The main points were:-</p> <ul style="list-style-type: none"> • AFCAP is funded by the British Government and works with National Governments. • The Technical Manager was pleased with the wide representation of entities, practitioners and professionals participating at the workshop. • Phase 1 ends in June. Phase 2 will start immediately afterwards and will run for 6years with more funding and will include AFCAP2 and ASIACAP. • The main object is to help entities resolve their challenges. AFCAP Management prepares Terms of Reference and engages experts to resolve issues. • Entities are required to manage outputs in order to take ownership for uptake and implementation in mainstream activities. • Expectations are that the workshops will lead to the improvement of the Manuals being discussed. • The manuals should be live documents and updating should be a continuous process as lessons are learnt through implementation. 	
<p>Introduction and Background by the Head of Maintenance Eng. Luis Fernandes</p>	
<p>The Head of Maintenance covered issues relating to passability, challenges being faced by ANE particularly during the rainy season, excessive erosion during the rainy season, shortage of materials and other technical challenges which were the drivers for the research projects carried out by ANE with technical assistance from TRL and others. The main points were:-</p> <ul style="list-style-type: none"> • There are passability challenges in the poor sandy areas which cover the extensive coastal areas. • Excessive erosion is also a major problem in these areas. • There is a need to determine the life-cycle costs of unpaved roads to improve their sustainability. A previous study of Engineering Standards and Life-Cycle Cost for unpaved roads was carried out and completed in 2006 and needs updating. The rate of gravel loss was found to be too high and recommendations were made for upgrading roads to sealed standard. • Another major drive for research is the need to reduce 	<p>Good gravel can be found in some parts of the western areas in Manica, Tete, Zambezia and Niassa Provinces.</p>

dependence on foreign standards and specifications and to develop more appropriate standards. This could help, for example, to minimise chemical stabilisation.

- The Regional Sands Project was carried out under ASANRA (Association of Southern African National Roads Authorities) where the Mozambique component was carried out by TRL and ANE. The study involved investigations on extensive sands deposits to determine technical parameter which would allow the sands to be used as base course without stabilisation.
- There is also a 'Calcrete Project' which involves the location of calcrete gravel deposits in Inhambane Province. The study involved determining the material properties of the calcrete for the purpose of developing technical specifications.
- There is a study on water conservation as part of the construction of drainage structures on roads, allowing for damming on the upstream side of the road and in disused borrow pits. The water can be used for irrigation or for animals. The project involved other entities including the Edwardo Mondlane University, the Environment and Health Ministries, and local Authorities. Its implementation is earmarked for AFCAP Phase 2.
- The Back Analysis Project involved the study of previously constructed Low Volume Roads. The results of performance analysis have contributed to the development of specifications for low volume roads.
- Several trials were carried out under the RRIP/AFCAP research which involved the use of innovative designs and construction of trials and training of over 300 technicians and engineers from contractors, consultants and ANE. The study also involved the monitoring of the trial sections.
- Institutional development:- ANE with TA from TRL and CSIR has embarked on the Research Centre Project which involves the setting up of a research unit within ANE which will ultimately build research capacity in ANE.
- A question was raised regarding the progress and outputs of the research work.

Good progress had been made which has led to the drafting of the manuals under discussion

Series 100 Preliminaries and General by Eng. Rubina Normahomed	
<p>Eng. Rubina covered the items under Series 100 in the Normas including the constraints and proposed changes in the new draft manual.</p> <ul style="list-style-type: none"> • Preliminary activities include mobilisation and demobilisation, taking insurance, encouraging the employment of local labour and women transparently, removal of grass and bush, removal of inappropriate soils, removal of abandoned vehicles and demolition and removal of concrete structures, were listed together with the relevant codes during the presentation. • It was stated that the limited funding for mobilisation was a major concern and was limiting contractors on what they could provide on site. • Generally contractors are not providing offices and there is nowhere to keep project documentation such as working drawings, copies of the contract documents, site instructions, quality control test results, etc. • Contractors were providing substandard accommodation on site and this was causing problems on site. • Contractors were failing to mobilise qualified personnel such as engineers and experienced operatives because site accommodation was very poor. • Any available qualified personnel and operatives do not want to stay on site and sometimes commute for long distances and are most of the time absent from site. • No contractors were taking insurance and this was creating many challenges on site. • When damages or washaways occurred during construction the contractors were not prepared to repair or replace the damaged structures or road sections and the client (ANE) ended up paying for this which, in turn, is too costly for ANE. In some cases there was no extra funding and the damages were never repaired. • It is difficult when accidents happen on site leading to injury or death when there is no insurance. • It was mentioned that more and more contractors prefer machine-based approaches instead of using labour-based methods. • Contractors argued that it is faster to use machine-based methods and in some areas labour is scarce. • Some provincial authorities mentioned that the quality obtained using machine-based methods is better than that obtained when labour-based methods are used. 	<p>It was discussed and resolved that adequate funding should be provided to allow for the provision of basic facilities on site.</p> <p>This was discussed and it was agreed that a minimal office space is necessary and should be provided for. The Normas should provide specifications so that contractors bid for the same standard of offices.</p> <p>This issue was discussed in detail and it was resolved that minimum standards should be achieved in order to attract the right personnel on site. The Normas should standardise the provisions for tender purposes.</p> <p>This issue was discussed extensively and the issue of cost of insurance was raised.</p> <p>It was resolved that though there are costs involved it is still cheaper to pay for insurance than to pay for repairs of damaged works or for compensating injured workers. It is necessary to look at the scope of the intervention to determine which works require insurance in relation to the budget.</p> <p>It was resolved that government policy that stipulates that labour-based methods be used in order to create employment and reduce poverty shall take precedence except in areas where labour is in short supply.</p>

- It was proposed to pay for mobilisation as follows:
 - 50% mobilisation when the contractor had fully mobilised on site.
 - 35% when half of the works are completed
 - 15% at the end of the contract.

There were mixed responses:

- The contractors did not like the idea of retaining the 15% until after completion of the contract.
- Others wanted 50% paid on completion of mobilisation and the other 50% at the end of the contract.
- It was stated that districts allow for construction of metal panel huts as part of provision of campsite accommodation and offices. There is however no provision for quality tests.
- It was stated that ANE's involvement in the district is to provide assistance on contractual matters and assessment of the works for payment certification.
- The main challenges being faced were stated as:
 - There is poor communication between district authorities and provincial authorities.
 - The district authorities were not being involved in the award of contracts
 - It was stated that the procurement process is taking too long and, even when the contract is signed, there is no clarity on the work activities.
- Code 190-191. These codes are used in the removal of abandoned vehicles and demolition and removal of concrete structures but there is no clarity on how to deal with broken-down vehicles and other obstacles such as dead animals.
- Project bill boards should be prepared according to the standards given in the Normas and a question was raised as to who should be the owner of the project bill boards
- There are illegal structures being built in the road reserve causing several problems:
 - They are causing obstructions and affecting the drainage system of the road.
 - The problem is persisting due to lack of reaction on the part of the owner of the road (ANE or Local Authorities).

After much debate it was generally noted that retaining the 15% or 50% till the end of the contract would not be favourable particularly for small scale contractors hence 50% shall be paid on completion of mobilisation and the other 50% when half of the works were completed.

The challenges were discussed and it was resolved that:

- Quality testing was necessary but not for very small project or maintenance works.
- The districts should be involved in all processes and including award of contracts.
- Districts should inform ANE to evaluate the works in time.

This challenge should be largely resolved through new Normas and procurement procedures that should be followed. However, the procurement process could be started earlier to allow enough time for the process.

This was discussed at length and it was agreed that the codes should not be limited to abandoned vehicles but should also include numerous other items like broken down vehicles, dead animals and other obstructions on the roadway.

It was resolved that the billboards shall be the property of the owner (ANE) once the contractor has been paid and can be reused in order to reduce costs.

It was resolved that heavy penalties should be incurred for illegal structures built in the road reserve.

Series 200 Drainage presented by Eng. Cremildo Mucavel	
<p>Eng. Mucavel covered all the activity codes given in the Normas on drainage structures. The importance of drainage was summed as follows:</p> <p style="text-align: center;"><i>‘Water is the enemy but only when the drainage system is inadequate’.</i></p> <ul style="list-style-type: none"> • Flooding, washaways and other flood damages were highlighted as causing major challenges during and after rainy seasons. • It was mentioned that climate change is a reality and the intensity of rainfall has increased as a result. This has had two major impacts on drainage. <ul style="list-style-type: none"> - This existing infrastructure cannot cope with resultant flood discharges resulting in the increase in the prevalence of flood damages. - The existing design parameters and specification for hydrological and hydraulics design are no longer appropriate for the increased flood intensity. • The use of culverts with small diameter (< 700 mm) was causing problems of blockage and maintenance (cleaning) and there is need for a standard in the Normas. • It was stated that the construction of drainage structures should be carried out by qualified and experienced personnel and that they should be available on site. • The supervision of the construction of drainage structures should be carried out by qualified and experienced engineers. • The use of alternative materials should be considered for the construction of drainage structures. 	<p>It was suggested that in areas affected adversely by climate change, the flood discharge should be calculated in consideration of a return period which is one level above the one given in conventional designs.</p> <p>It was agreed that the minimum diameter of the culverts shall be above 700 mm and this should be stipulated in the Normas.</p> <p>The use of alternative materials in the construction of drainage structures is already covered in the draft Normas including the use of stone masonry and geo-cells, but needs to be enhanced to include other materials.</p>

Series 300 Earthworks- Construction of Pavements - by Engineer Rubina Normahomed and Kenneth Mukura	
<p>Eng. Rubina listed the activity codes covering earthworks including:-</p> <ul style="list-style-type: none"> - Preparing and compacting road bed - Stockpiling, transporting and compacting fill. - Preparing and compacting subgrade including formation of drains. - Mass-haul including specifications of materials. - Borrow pit management. - Construction of sub-bases and bases (mechanically stabilised, ETB, blended bases, armoured bases, etc. <ul style="list-style-type: none"> • Performance-based specifications on the PP vs GM chart were proposed which take into account rate of gravel loss and roughness progression and will take precedence over the SP vs Gc chart for riding quality. • It was stated that lack of resources was a major problem to carry out the various activities. • The participants stated that there is need to train the contractors especially on the construction aspects pertaining to the innovative pavements such as ETB, blending and armouring. • The contractors are lacking the requisite equipment and personnel. • It was proposed that prospecting for materials should be carried out in advance of the contract and that it is not appropriate for the contractor to look for borrow pits when the works have already started. • A question was raised regarding the situations where innovative solutions should be used. 	<p>Many participants were not familiar with the PP vs GM specification. It was agreed that performance-based methods were important and riding quality should be a secondary requirement.</p> <p>It was agreed that training was necessary and could be carried out under AFCAP Phase 2.</p> <p>Contractors were encouraged to invest in order to be able to carry out the works and be competitive.</p> <p>It was decided that this should apply to materials from borrow pits only and materials such as aggregate, bitumen, steel reinforcement, etc. shall be the responsibility of contractor.</p> <p>The use of innovative solutions should be considered in situations where there is shortage of good materials or where it leads to more economic designs.</p>

Series 400 Construction of surfacings by Mike Pinard and Kenneth Mukura	
<p>Mike Pinard presented on the different types of surfacing covering bituminous and non-bituminous surfacings. The surfacings are:-</p> <ul style="list-style-type: none"> - Surface treatment, asphalt, sand seals, Otta seal, which are commonly used in Mozambique. - Cape seals, penetration macadam, slurry seal, and other bituminous surfacings which are not commonly used in Mozambique. - Discrete elements such as concrete block pavers which are commonly used in Mozambique. - Discrete elements, such as bricks, cobble stones, stone sets, etc. which are not commonly used in Mozambique. <ul style="list-style-type: none"> • Surfacing have different performance characteristics and quality requirements and they also have different service lives. The presentation covered the criteria used in the selection of the most appropriate type of surfacings. • Construction of surfacings using cutback binder, which must be applied at high temperatures, is not suitable for labour-based construction. • Road environment was highlighted as a major factor, e.g. discrete elements are more suitable for surfacing on steep slopes than surface treatment because the binder could flow off the surface before aggregate is applied. • Discrete elements surfacings are more expensive but are much more durable and could be a cheaper option in life-cycle terms. 	<p>It was agreed that the types of surfacings that are not commonly used in Mozambique should be demonstrated so that they can be adopted.</p> <p>Where there is a choice, engineers should look at different surfacing options and go through a selection process which includes calculation of life-cycle costs.</p>

Kenneth Mukura presented on the different activity codes given under Series 400 including:-

- Application of prime coat and fog spray.
 - Recycling of existing bituminous surfacings
 - Constructing structural surfacings such as asphalt concrete, penetration macadam, etc.
 - Constructing thin bituminous surfacings such as single and double surface dressings, slurry seals, Otta seals, sand seals, single surface dressing with sand capping, single Otta seal with sand capping, etc.
- Surfacing should be properly designed and that the specifications which are given in the codes are indicative.
 - Quality Control. It was mentioned that there was inadequate testing of surfacing materials and in most cases binders were not being tested at all. This was compromising quality and this has been made a requirement in the activity codes.
 - Control on application rates was also very limited
 - Specifications for the rolling of surfacings given in the previous Normas were incorrect and grossly inadequate and this has been corrected in the revised Normas.
 - It was proposed that 150/200 pen binder obtained by cutting back 80/100 pen with diesel should be used unless or otherwise it is not suitable due to the road environment (such as very hot climate where 80/100 is more suitable). Binders such as MC3000 obtained from cutting back 80/100 with kerosene were found to be hardening too quickly thus given a shorter service life.
 - The issue of remedies for early aggregate loss was raised during discussion on what should be done when failures such as aggregate loss or bleeding start occurring after surfacing.

The design procedures and specifications are given in the draft Planning and Design Manual.

All materials for surfacings including bitumen should be tested and approval for use on site shall be given in writing. Also approval of surfacing works shall be based on quality measurements.

The changes which included a significant increase in the number of passes were accepted.

This was agreed but questions were raised regarding availability of 150/200 pen. It was explained that 150/200 pen can be procured from South Africa or it can be made on site by adding diesel to 80/100 pen.

Remedies of fog spray for stone loss and application of quarry dust in case of bleeding were discussed.

Series 500 Auxiliary works presented by Engineer Cesar Macuacua	
<p>This presentation covered the codes for the provision and placement of vertical and horizontal road signs, kilometre markers, protection barriers, traffic calming measures such as humps.</p> <p>It was explained that the regulation road signs is based on SADC regulations 51/2009 of 29/9.</p>	<p>Not many changes were made to the Series as a result.</p> <p>In the SADC standards, arrows are obligatory and should be used in conjunction with vertical signs placed at 180 m, 60 m and 24 m before the road markings.</p>
<p>The factors determining the quality of the paint were listed:-</p> <ul style="list-style-type: none"> • It must be visible both during the day and the night. • Drying time should be approximately 7 min. • Specification for the paints shall be based on life-cycle costs i.e. cheap paints with a short life span are not recommended. • The specification shall also be based on its retro-reflectivity. • The paint shall be suitable for the local environmental conditions. • The paint should be appropriate for the type of pavement or surfacing on the road. • The colours shall be white and yellow for road markings (horizontal signs). • Painting shall not be carried out in the following conditions: <ul style="list-style-type: none"> - When the temperature is < 10°C. - When it is windy - In the rainy season. - In winter. • It was indicated that measurement shall be in km for dotted hatched and continuous lines. The different lines shall have different unit rates. In developing the unit rate the width shall be considered to be 15 cm, or as measured, and the unpainted spaces on hatched lines shall not be included in calculating the painted areas and this shall be accounted for in the differences in unit rates. • The other option is to measure the painted area in m² but this is not recommended. • Vertical signs. The metal sheets shall be 1.4 mm thick and 2 mm. Class 1 should be used for the material quality which gives a life span of 7 years. The sheet shall be cut to the required dimensions and connectivity or welding together of two or 	<p>These parameters should be clearly indicated in the codes.</p> <p>It is important to guard against counterfeits.</p> <p>Roads with carriageway less than or equal to 5 m shall have no centreline markings but only yellow lines on the edge of the carriageway.</p> <p>Questions were raised about whether a road section completed in winter should be left without road markings. The resolution was that no road section should be left unmarked for long periods of time.</p> <p>There is need for specifications for off-sets from the centreline or road shoulders.</p> <p>The codes should distinguish between danger and warning signs.</p>

<p>more pieces is not permissible.</p> <ul style="list-style-type: none"> • The specification for humps is 3.7 m width and 0.10 m height (Regulation 189/2013 of 7/11) • Protection barriers are covered under code 520. Sometimes the barriers are placed too close to the carriageway and they become obstacles. • The specification for the offsets of trees and other obstacles is not clear in the Normas and needs attention. • Signs were being vandalised through several ways. <ul style="list-style-type: none"> - Graffiti which disfigures the signs. - Damage - Theft. 	<p>All humps should conform to this standard in order to avoid the placement of hazardous humps on the roads.</p> <p>There is need to specify the off-sets of the barriers from the shoulders.</p> <p>Trees and any obstacles shall not be allowed in the shoulders and shall be at such a distance that they do not compromise line of sight.</p> <p>It was agreed that sensitisation of the local community could be effective.</p> <p>The Normas shall stipulate the need to perforate the signs where necessary to make the materials less useful and therefore less attractive.</p>
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Series 600 Structures by Kenneth Mukura	
<p>The activities codes covered under Series 600 were presented and they included:</p> <ul style="list-style-type: none"> - Excavation of foundations. - Construction of drifts and causeways. - Provision, cutting, bending and fixing of steel reinforcement. - Concrete works. - Auxiliary works on structures (PVC drainage pipes, expansion joints, provision and placement of bridge bearings, construction of parapets railings and sidewalks. - Transportation, mounting and launching Bailey Bridges. 	
<ul style="list-style-type: none"> • Structures should be built by qualified and experienced personnel and such personnel should be available on site during the execution of activities. • Structures are designed for a long service life which is much longer than that of the pavement and should therefore be constructed with less risk. • The quality control of concrete works is determined through cube strength tests and full results can only be obtained after 28 days. This means that the structural member should be demolished should the tests results fail to meet the minimum strength specified in the design. • It was mentioned the most vulnerable part of the structure are the backfills and approaches and these are often washed away. 	<p>It was agreed that proper mobilisation of human resources and appropriate camping shall be provided for in the tender and contractors' bids.</p> <p>For big structure such as bridges it is necessary to have a site laboratory.</p> <p>Strong protection works should be constructed with proper key walls where</p>

- Blockage was mentioned as a major problem on structures.
- Compaction is critical in the placement of concrete and should be carried out properly to remove air bubbles that may be trapped in the concrete.
-
- Concrete gains strength through hydration which requires water. Hence curing should be carried out properly and for the duration stipulated in the design or by the Engineer (not less than 7 days for structural members).
- Finishing involves rubbing and filling of honey combs for strength (minimum covered required) and aesthetics.

necessary. This should be clear in the codes.

In order to minimise blockage, suggestions were made to clean up to a minimum of 50m upstream and sensitise the communities living along the river.

- Where poker vibrators are used the compaction procedure should involve placing the poker vibrator in and out (in quickly and out slowly) in order to vibrate the bubble to the surface. Compaction should be completed when bubbles stop popping out.
- When labour based methods of compaction are used the concrete should be made more fluid by increasing the water/cement ratio.

Series 700 Quality Control by Eng. Raquel Langa

Eng. Raquel covered the activity codes given in Series 800 including:

- Preparation and implementation of the Quality Control Plan.
- Sampling materials from stockpiles in the borrow pits 3 – 5 samples per stockpile.
- Carrying out materials tests covering test procedures for grading, plasticity, compaction and CBRs tests and specific gravity.
- Quality of works test including field density tests, slump tests, concrete cube strength tests and DCP tests.
- Quality control was previously the responsibility of the contractor but it was proposed that the preparation and implementation of the Quality Control Plan should be the responsibility of the Engineer but the Engineer should collaborate with the Contractor.
- It was mentioned that there was limited testing on site because there are no site laboratories. These could not be established because there are no provisions in the budget. Tests were being carried out by provincial laboratories and this is difficult for projects in remote areas.

There was a lot of debate regarding the capacity of the Engineers, particularly the Fiscais on site, to execute the plan. However, it was agreed that the Engineer shall take responsibility and work with the ANE provincial laboratory and the contractor shall cover the logistics.

It agreed that there shall be provision for a mini-site laboratory with minimal equipment for basic tests such as grading, plasticity, densities and DCP.

- It was mentioned that codes for bitumen tests were not included in Series 700.
- The capacity of ANE laboratories was questioned in terms of the personnel and equipment and whether they could carry out all the tests given in Series 800.
- It was mentioned that there have been serious problems relating the compaction on site and the approval methods were not proper. To improve on this a compaction judgement chart has been incorporated in the Normas which will standardise the analysis of field density results. The chart shows areas for acceptance, conditional acceptance and rejection.
- The issue of the calibration of equipment was raised during discussions.
- A question was raise on who should be responsible for quality control. There was a lot of debate on this and this following points were noted:
 - The contractor should be responsible because he needs to produce works according to the specifications in the contract.
 - The consultant should be responsible because he is the one responsible for the approval of works.
 - The consultant must have capacity to carry out tests because it is sometimes difficult to coordinate.
 - There are budget constraints which limit the full implementation of the required quality control measures.
 - There is a culture of not doing things properly.
 - Bids are sometimes under-priced leading to compromises on quality.
- It was mentioned that there was lack of knowledge and experience in quality control and technical aspects of the works in ANE, the consultants particularly the fiscais and the contractors personnel, particularly the operatives, which is compromising the quality of works.

This was noted and it was agreed that it was necessary to incorporate them.

It was mentioned that most laboratories were capable of carrying out the tests but there are other specialised tests such as bitumen tests which could be referred to LEM in Maputo.

There were discussions regarding the use of the chart and it was agreed that the chart should be incorporated in the Normas and implemented.

It was stated that most equipment had been calibrated and LEM will be calibrating the equipment in the next 3 years.

After a long debate it was agreed that all are responsible but the Engineer shall take overall responsibility for quality control through inspections are testing using ANE provincial laboratories for approval of works.

It was agreed that there is need for training and capacity building and that all entities and the contractors in particular need to invest in building capacity to execute the works. The Chimoio Training Centre could provide part of the training.

Series 800 Maintenance by Eng. Fernandes and Kenneth Mukura	
<p>Eng. Fernandes presented on the challenges being faced in the maintenance of roads and he raised some serious issues for consideration.</p> <ul style="list-style-type: none"> - Every year annual achievements are reported as 80% or 90% in terms expenditure but is this translating to good quality roads on the ground? - It is important that the roads under maintenance are maintainable but a substantial proportion of the network is not. - The objective of maintenance is to protect investments in roads but there is deficiency in maintenance leading to delayed or backlog of maintenance. There is much less periodic maintenance and more routine maintenance. - It is difficult to get maintenance information from local authorities including districts. - It is important to determine which method of maintenance is more effective, level of service or measurement contracts. - Currently, there is not enough expenditure on maintenance. - Does the private sector have capacity for execution and supervision? - There is a need to make maximum use of available resources including knowledge and engineering experiences. - Are the procedures appropriate? The updated Normas is addressing this aspect of work standards. <ul style="list-style-type: none"> • A question was raised on what ANE’s policy is on tertiary and vicinal roads. • Most of the challenges are compounded by lack of adequate funding. • District roads do not have adequate funding. <ul style="list-style-type: none"> • A question was raised as to how many contractors and consultants had been penalised for non-performance insinuating that the system was too lenient. 	<p>ANE provides technical assistance to the districts on request.</p> <p>There was general agreement but it was highlighted that sometimes the budget was being wasted because of the poor performance of contractors</p> <p>Maintenance camps that were set up under KFW funding were being under-utilised.</p> <p>Improvement in the use of available resources is necessary.</p>
<p>Kenneth Mukura presented activity codes under Series 800 covering:</p> <ul style="list-style-type: none"> - Grass cutting and removal of bushes. - Drain clearing (side, mitre and catchwater drains) - Clearing culverts and causeways and bridges. 	

<ul style="list-style-type: none"> - Removal and disposal of the rubbish soils and debris. - Repairing timber and metallic elements. - Repair of chipped or broken concrete and stone masonry elements with cement mortar. - Repair of scour checks and slopes. - Maintenance of road signs, km markers, protection barriers and metal elements. - Maintenance grading both light and heavy and tyre dragging - Regravelling including haulage of materials. - Crack sealing with bitumen and slurry. - Pothole patching and edge break repairs. - Repair of small defects such as bleeding. - Fog spray for rejuvenation of surfacings and reseals. - Repair of subbase and base as part of pothole patching and edge break repairs. <ul style="list-style-type: none"> • There is need for a code for removal of anthills including the treatment required. • A comment was made that in practice hot mix is performing better than cold mix and hot mix asphalt is preferred in pothole patching. • A question was raised as to whether Codes 816 – 819 (removal of improper materials) should be moved to Series 300 as part of earthworks. • Recommendation to stabilise soils with cement during pothole patching , Code 899, was raised during discussion. Apparently the pothole patching where cement stabilised soil was used were opening up. Participants also queried the logic of applying cement when the material met the CBR requirements for base without stabilisation. • Also there are delays while waiting for the soil-cement to cure. 	<p>It was agreed to add the activity code on anthill removal and treatment.</p> <p>This needs to be investigated because it could be that they are applying less binder in cold mix but the point was taken and hot mix asphalt will be included in Series 800.</p> <p>These codes refer to materials that would have accumulated in the drains, culverts and bridges. Series 300 is for new constructions.</p> <p>It was explained that use of cement is both to improve the quality of the material and to compensate for reduced compaction because lighter equipment is used for compaction compared to that of heavy plant used during normal construction. Stabilisation may not be necessary on lightly trafficked roads.</p> <p>Usually it is not necessary to wait. After backfilling stable 60 prime can be applied followed by cold or hot mix asphalt.</p>
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PLANNING AND DESIGN MANUAL		
Planning by Mike Pinard		
<p>Mike Pinard presented on the first section of the draft Planning and Design Manual covering the various aspects of the planning process. Aspects of planning include:</p> <ul style="list-style-type: none"> - Determination of route and alignment of the road. This also takes into account, availability of materials, drainage, geotechnical problems and the need to minimise earthworks - Preliminary surveys (DCP, geometry, problematic areas, etc.). - Traffic counts and traffic engineering including determination of traffic loading. - Preliminary designs <ul style="list-style-type: none"> • Planning is an important part of any project because poor planning or lack of it could spoil the whole project and lead to a significant waste of resources. • The main problem is the lack of funds for project planning and to carry out the necessary investigations. • The capacity of the consultants at provincial level may be limited and they may not have enough time to carry out proper planning. Knowledge is required of:- <ul style="list-style-type: none"> - Road design manuals - Road and other engineering reports - Remote sensing - Topographical and soils maps - Geological reports and maps - Meteorological and climate data - Land use/ land cover. - Local knowledge - Statistics and future plans. 		<p>It is difficult to determine what should be done and what should be left out in dealing with LVRs.</p> <p>Funding should be made available for this exercise.</p> <p>Training is necessary.</p> <p>There may be need for external consultants.</p> <p>Most of this information is available in Mozambique.</p>
Drainage Design by Dr. John Rolt		
<p>Dr. Rolt covered the essential aspects of geometric design including:</p> <ul style="list-style-type: none"> - Traffic composition – highlighting the differences of traffic composition and how they affect the geometry. This includes motor cycle and non- motorised traffic (bicycles and carts) - Topography – curvature is much more restricted in mountainous areas than on flat sections. - Road surface type (sealed or unsealed) 		

<ul style="list-style-type: none"> - Construction technology (labour-based requires minimal earthworks). - Safety, horizontal and vertical curvature, design and operating speeds, road width, etc. - Economic, financial and environmental consideration. • There are many combinations that are considered e.g. <ul style="list-style-type: none"> - Terrain (flat, undulating, hilly and mountainous) = 4 - Traffic classes = 4 and 5 - Surfacing type (sealed and unsealed) = 2 - Etc. • The computations have already been carried out and geometric standards for the various combinations of parameters can be read from the Tables given in the design Manual. The geometric design parameters include <ul style="list-style-type: none"> - Curvature - Stopping sight distances - Super-elevations - Gradients - Crossfall - Etc. 	
<p>Drainage Design by Dr John Rolt</p>	
<p>Dr. Rolt covered aspects of drainage design detailed in the manual including:</p> <ul style="list-style-type: none"> - Hydrological design – the determination of precipitation and accumulation of water at the crossing point. The methods that are used are: <ul style="list-style-type: none"> - The direct observation method - The Rational Method (commonly used in Mozambique). - Hydraulics – the determination of flood discharges and sizing of the structures. <ul style="list-style-type: none"> - The use of charts or nomographs for sizing culverts is the simplest and easiest. • Erosion control is one of the most important aspects of drainage design. • It was stated that provinces have no topographical maps to enable them to calculate the catchment areas. • The difficulty of estimating rainfall intensity was raised. • It is important to determine the high risk areas (downstream of dams, cyclone prone areas) where unusual flood discharges are 	<p>It was agreed that it should be included and should have its own subsection.</p> <p>Maps are available in Maputo at 150 Mts (\$5) each so provinces should procure maps that cover the whole of their provinces.</p> <p>This information can be obtained from the Meteorological Department in Maputo or in the absence of these data, 3 hours rainfall duration can be assumed.</p> <p>In this case the flood return periods should be extrapolated and a Table is provided in</p>

likely to occur.	the Manual for this. Considering a flood discharge from a storm of double the usual storm return period might be sufficient. This is equivalent to an increase of about 35%.
Pavement design by Dr John Rolt	
<p>Dr, John Rolt's presentation covered aspects of structural design of pavements:</p> <ul style="list-style-type: none"> - Traffic loading - Materials specifications - Pavements for paved and unpaved roads - Pavement structures of paved roads for difference types of surfacing. <ul style="list-style-type: none"> • The traffic loading is divided into 5 categories (LV1 to LV5) up to a maximum of 1 MESA. Details are given in the Manual. • Subgrade strength is also divided into 5 categories (S1 – S6 Details are given in the Manual. • For gravel roads performance-based specifications are given in the PP vs GM chart and other specifications for riding quality are given in the SP vs Gc chart and the former takes precedence. • Tables have been developed for pavement thicknesses for unpaved roads for different traffic loading categories and subgrade strengths. • Different grading envelopes are provided and should have a GM value between 1.65 and 2.65 • Materials are divided into 9 categories (G3, G7, G15, G25, G30, G55, G65 and G80) where the value represents CBR. • On LVRs and for traffic loading less than 0.05MESAs, PIs and PMs can be relaxed to maxima of 18 and 450 respectively particularly on pedogenic materials such as laterite. • The different thicknesses of layer combination for subbase and base can be read off from the charts depending on whether the surfacing is structural, semi-structural or non- structural 	<p>The change to performance based specifications was accepted.</p> <p>Research has shown that materials with a GM between 1.0 and 1.65 and above 2.65 can also perform well. This shall be considered.</p> <p>This is an empirical design which is more appropriate at provincial levels.</p>
The DCP Design Method by Mike Pinard	
<p>Mike Pinard presented on the DCP-DN design method which was developed some time ago in South Africa and is now being promoted for the use in the design of low volume roads under AFCAP.</p> <ul style="list-style-type: none"> • It was mentioned that the DCP-DN Design Method involves DCP testing in the normal way but the penetration data is not converted to CBR and it is simply expressed as DN which is the 	

penetration per blow.

- It has the advantage over a traditional CBR method of assessing subgrade strengths that many more tests can be carried out which gives it a tremendous advantage of statistical soundness over the normal CBR test method.
- Tests are carried out at intervals of 50m to 200m depending on variability and class of road.
- Each test shall be carried out to a depth of 800mm minimum.
- The pavement shall be divided in 150mm thicknesses from the surface where the top 150mm shall be the base and the subsequent layer below it shall be the subbase and so on.
- Uniform sections are identified and such sections shall be designed uniquely.
- The percentile minimum strength (DN value) for each layer in each section shall be determined and these shall be representative of the layers for design purposes.
- The DN values obtained shall be compared with the required values of DN given in the empirical design catalogue and it shall be determined whether pavement is adequate or requires strengthening.

Surfacing Design by Kenneth Mukura

The presentation covered the design parameters and specifications for the different types of surfacing. This included sand seals, surface dressings, single surface dressing with sand capping, Otta seals, single Otta seal with sand capping, penetration macadam, cold mix, etc.

- Grading specifications for sands were given (nominal maximum of 4.75 mm or 6.7 mm), applications rates of 7L/m² for sand and 1.2L/m² of 150/200 pen binder.
- The designs include:-
 - Single surface dressing (13.2 mm or 10 mm) with application rates determined from the equations and charts given in the Manual.
 - Double surfaced dressing 13.2mm/19mm. Also application rate are determined from the equations and chart given in the Manual.
- The designs include slurry seals - this is a mixture of sand, cement, emulsion and water.
 - Production of the slurry seal.
 - Inert (sand) 1m³
 - Emulsion 260 litres
 - Cement 0.01m³

- Water 235 litres (adjust to get good workability)

- The designs include Otta seals using graded aggregate or crushed stone or sieved natural gravels with maximum size aggregate of 19 mm (for coarse grained Otta seals) and 13.2 mm for fine graded Otta seal. Application rates of 16L/m² for aggregate and 2L/m² for binder 150/200 pen.
- The designs include Penetration Macadam -two layers:
 - 1st layer of 20-40 mm aggregate
 - 2nd layer of 5-13 mm aggregate
 - Binder application of 8L/m² before application of first layer and 2-3L/m² after second layer.
- The designs include Cold Mix, a mixture of aggregate with emulsion SS60 (7% residual bitumen by weight). Grading specification is given in the Manual.

2. Photo highlights



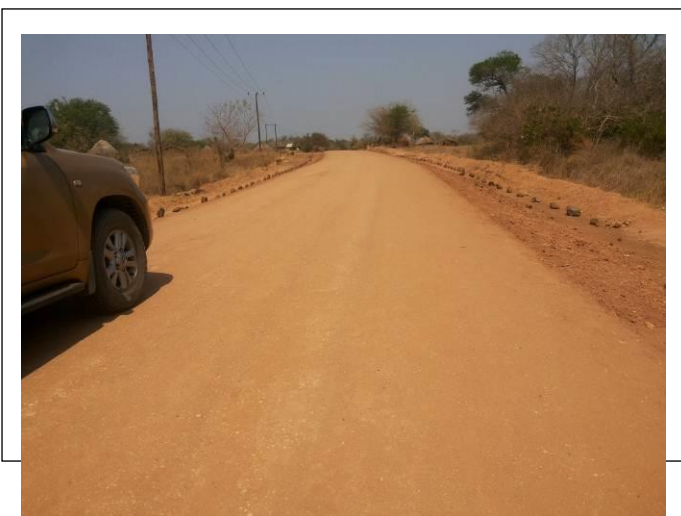
Contractor's site camp

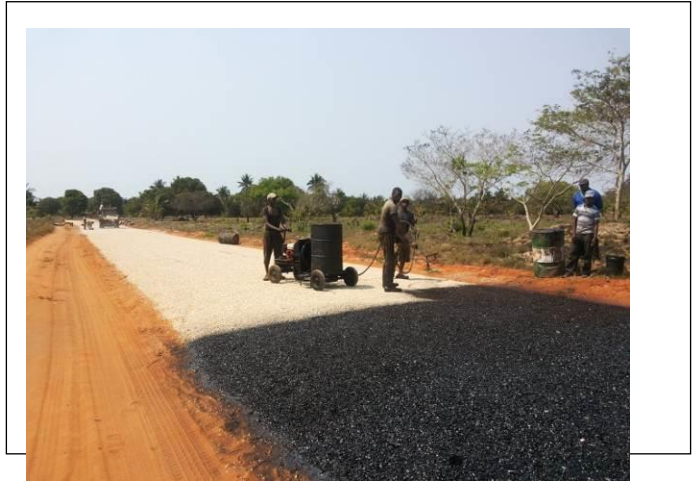


Flooding



Construction of armoured base





Flood damage



Where is the truck? Overloading is bad for LVRs



3. Workshop Evaluation

1. General Objectives

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
Objectives of the workshop were achieved.	18	20	6	2	3
Intended results for the seminar were achieved	1	32	24		
The workshop will increase interest in the use of the Work Norms Manual	4	36	2		
The workshop will increase interest in the use of the Planning and Design Manual for Low volume Roads.	9	30	1		
The workshop will increase interest in the use of alternative materials and innovations in the construction, rehabilitation and maintenance		41	1		
Workshop documents	34	10			

2. Presentations

2.1 Introductions and Background – Eng. Luis Fernandes

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	14	28			
The Facilitator/Moderator was effective and contributed in encouraging debate	13	6			

2.2 Series 100 – Preliminaries and General – Eng. Rubina Normahomed

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	12	16	6		
The Facilitator/Moderator was effective and contributed in encouraging debate	20	19	3		

2.3 Series 200 – Drainage – Eng. Cremildo Mucavel

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative		32	9		
The Facilitator/Moderator was effective and contributed in encouraging debate	25	17			

2.4 Series 300 – Construction of Pavements – Innovative Pavements – Kenneth Mukura

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	22	12			
The Facilitator/Moderator was effective and contributed in encouraging debate	4	26	6		

2.5 Series 300 – Construction of pavements – Improvements made in the draft manual – Eng. Rubina Normahomed

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	5	26	11		
The Facilitator/Moderator was effective and contributed in encouraging debate	11	25	6		

2.6 Series 400 – Construction of surfacings – Surfacing options and innovations – Mike Pinard

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative		26			
The Facilitator/Moderator was effective and contributed in encouraging debate	8	29	5		

2.7 Series 400 – Construction of surfacings – Improvements to made in the draft manual – Kenneth Mukura

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	2	32	8		
The Facilitator/Moderator was effective and contributed in encouraging debate	42				

2.8 Series 500 – Auxiliary Works – Eng. Cesar Macuacua

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	2	32	10		
The Facilitator/Moderator was effective and contributed in encouraging debate	4	38			

2.9 Series 600 – Construction of Structures – Kenneth Mukura

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	8	14	17	3	
The Facilitator/Moderator was effective and contributed in encouraging debate	17	23	2		

2.10 Series 700 – Quality Control – Eng. Raquel Langa

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	34	6	1		
The Facilitator/Moderator was effective and contributed in encouraging debate	19	17	6		

2.11 Series 800 – Maintenance – Challenges being faced in maintenance – Eng. Luis Fernandes

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	21	19	2		
The Facilitator/Moderator was effective and contributed in encouraging debate	12	25	4		

2.12 Series 800 – Maintenance – Proposed changes in draft manual – Kenneth Mukura

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	35	7			
The Facilitator/Moderator was effective and contributed in encouraging debate	39	1	2		

2.13 Geometric Design for Low Volume Roads – Dr. John Rolt

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	7	20	12	3	
The Facilitator/Moderator was effective and contributed in encouraging debate	10	29	3		

2.14 Project Planning including Materials Prospecting, Traffic Engineering, Preliminary Design and Cost Estimates – Mike Pinard

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	30	12			
The Facilitator/Moderator was effective and contributed in encouraging debate	10	32			

2.15 Drainage Design including Hydrological and Hydraulics Design and Climate Change Considerations – Dr. John Rolt

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	17	19	1		
The Facilitator/Moderator was effective and contributed in encouraging debate	17	12	11		

2.17 Pavement Design using the DCP Design Method – Mike Pinard

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	9	27	7		
The Facilitator/Moderator was effective and contributed in encouraging debate	25	17			

2.18 Pavement Structures for Low Volume Roads with Non-structural, Semi-structural and Structural Surfacing – Dr. John Rolt

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	2	30	7	1	
The Facilitator/Moderator was effective and contributed in encouraging debate	23	17	2		

2.8 Series 500 – Design of Surfacing – Testing and design considerations for aggregate and bitumen and design of different options of surfacings – Kenneth Mukura

Item	Fully agree	Agree	Partially agree	Disagree	Disagree completely
The theme was properly presented and it was clear and informative	21	16	5		
The Facilitator/Moderator was effective and contributed in encouraging debate	9	31			

3. Workshop Venue and Organisation

Item	Excellent	Very Good	Good	Poor	Very Poor
Conference Room	4	29	9		
Accommodation	22	20			
Workshop Logistics (transport, etc.)	40	2	1		
Secretariat	34	7	1		
Quality of Meals	9	27	6		
Interpretation	20	20	1		

4. List of Participants

Regional Workshop (Southern) – Maputo

ITEM	Name	Organisation	Position	Province
1	Eng ^o Atanásio Mugunhe	ANE – HQ	General Director	Maputo
2	Eng ^o Silvestre Elias	ANE - DIMAN	Director of Maintenance	Maputo
3	Eng ^a Rubina Normahomed	ANE - DIMAN	Maintenance Engineer	Maputo
4	Eng ^o Miguel Coanai	ANE - DIPLA	Director of Planning	Maputo
5	Eng ^o Luis Fernandes	ANE - DIMAN	Head of Maintenance	Maputo
6	Eng ^o César Macucua	ANE - DIMAN	Engineer, Road Safety	Maputo
7	Eng ^o Avelino Machava	ANE - DIMAN	Engineer, Maintenance	Maputo
8	Eng ^a Raquel Langa	ANE - DIPRO	Engineer, Projects	Maputo
9	Eng ^o Manuel Cossa	ANE - DIMAN	Engineer, Maintenance	Maputo
10	Eng ^o Mauro Zulo	ANE - DIMAN	Engineer, Maintenance	Maputo
11	Eng ^a Joana Guiele	ANE - DIMAN	Engineer, Maintenance	Maputo
12	Eng ^o Delcídio Dove	ANE - DIMAN	Engineer, Maintenance	Maputo
13	Eng ^o Januário Maunze	ANE - DIMAN	Engineer, Maintenance	Maputo
14	Eng ^a Ludovina Nhancolo	ANE - DIMAN	Engineer, Maintenance	Maputo
15	Eng ^a Anastácia Maurício	ANE - DIMAN	Engineer, Road Safety	Maputo
16	Eng ^o Filipe Sitole	ANE - DIMAN	Engineer, Road Safety	Maputo
17	Eng ^o Amândio Mutowo	ANE - DIPRO	Engineer, Projects	Maputo
18	Eng ^o Crimildo Mucavele	ANE - DIPRO	Engineer, Projects	Maputo
19	Eng ^a Emilia Tembe	ANE - GAT	Head of Department	Maputo
20	Eng ^o Anibal Novunga	ANE - DIPLA	Engineer, Planning	Maputo
21	Eng ^o Cardoso Munguambe	ANE - DIPLA	Engineer, Planning	Maputo
22	Mr. Kenneth Mukura	TRL	Project Manager	Maputo
23	Eng ^o Luis Abilio	ANE-DIAFI	Engineer	Maputo
24	Eng ^o Jeremias Mazoio	DPANE Maputo	Head of Planning Department	Maputo
25	Eng ^o Nacir Amir	DPANE Maputo	Head of Technical Department	Maputo
26	Eng ^o Andre Chongo	DPANE Maputo	Engineer	Maputo

27	Engº Jorge Rungo	DPANE Maputo	Engineer	Maputo
28	Engº Carlos fortes	Road Fund	Engineer	Maputo
29	Mr. Nkululeko Leta	AFCAP	Technical Advisor	Maputo
30	Mr.Fujishima	JICA	Consultant	Maputo
31	Dr. John Rolt	TRL	Senior Researcher	Maputo
32	Mike Pinnard	Consultor	LVR Expert	Maputo
33	Engº Carlos Cumbana	LEM	Engineer	Maputo
34	Mr. Eduardo Fortunato	LNEC (DFID)	Consultant	Maputo
35	Engº Sergio Orlando	Municipal of Marracuene	Engineer	Marracuene
36	Engª Ilda Sumbana	Road Fund Provincial Delegation- Maputo	Delegate	Maputo
37	Engº Jorge Mugare	Consultant- CPG-Maputo	Senior Inspector	Maputo
38	Engº Rui Serra	Consultant- CPG-Maputo	Team Leader	Maputo
39	Engº Hernesto Correia	DPANE Gaza	ANE Delegate	Gaza
40	Domingos E. Banze	DPANE Gaza	Engineer	Gaza
41	Engº Nelson Tsanzane	DPANE Inhambane	ANE Delegate	Inhambane
42	Engº Alberto Jetimane	DPANE Inhambane	Engineer	Inhambane
43	Engº Adamo Estumbi	DPANE Manica	ANE Delegate	Manica
44	Engº Freitas E.Muayane	DPANE Manica	Engineer	Manica
45	Engº Robot Jane	Chimoio Training Centre	Director	Manica
46	Engº Liberto C.Suleque	Chimoio Training Centre	Engineer	Manica
47	Engº Agapito M. Da Cruz	DPANE Sofala	Engineer	Sofala
48	Engº. Kudzipa	Consultant: Stange Consult - Gaza	Team Leader	Gaza
49	Engº. Lino de Almeida	Consultant: CPG- Inhambane	Team Leader	Inhambane
50	Engº.Gerald Kabwibwi	Consultant: Scott Wilson- Manica	Team Leader	Manica
51	Engº.Emmanuel Munatsi	Consultant: Scott Wilson- Manica	Team Leader	Sofala
52	Engº Janio Sampaio	District of Dondo	Engineer	Sofala
53	Engº Alberto M.Armando	District of Nhamatanda	Engineer	Sofala
54	Engº Domingos Calisto	Contractor: Karina	Engineer	Sofala

		Construções-Sofala		
55	Engº Meque Raul Gueraí	Contractor: Adam's Construções	Engineer	Sofala
56	Engª Maria Macucua	ANE - Sede	Photographer	Maputo
57	Engº Cândido P.	District of Chimoio	Engineer	Manica
58				
59	Arnaldo L. Manuel	SDPI – District of Manica	Director	Manica
60	Mr. Souto	Municipal of Boane	Engineer	Boane
61	Engº. Shadreck Takuva	Consultant: Scott Wilson	Engineer	Sofala
62	Engº Raimundo	Contractor	Engineer	Maputo
63	Engº João Chivambo	District of Chokwe	Engineer (SDPI)	Gaza
64	Engº Armindo Anastacio	District of Xai-xai	Engineer (SDPI)	Gaza
65	Engº Guidion Joao Massango	District of Maxixe	Engineer	Inhambane
66	Engº Alberto Tamela	District of Zavala	Engineer	Inhambane
67	Engº Casimiro Alberto Chope	Contractor-Max Construções	Engineer	Gaza
68	Engº Cristiano Bila	Contractor-CBC Construções	Engineer	Gaza
69	Engº Inocência Filipe Bambo	Contractor-IFB Construções	Engineer	Inhambane
70	Engº Utímio Oliveira Monteiro	Contractor- Construções Pedrito	Engineer	Inhambane
71	Caetano Vicente	Contractor- ECMOR	Engineer	Manica
72	Erca Chissano	Contractor- CCH	Engineer	Maputo
73	Engº Nestor	Contractor- TOYA	Engineer	Maputo
74	Nelson A.Mussa	Contractor- JE	Engineer	Manica
75	Efraime	Contractor		
76	Melaline Lunbe	Contractor	Engineer	
77	Engº Xavier Zandamela	ANE - Sede	Engineer	Maputo

Regional Workshop (Northern) – Nampula

ITEM	NAME	ORGANISATION	POSITION	PROVINCE/ COUNTRY
1	Eng ^o Silvestre Elias	ANE - DIMAN	Director of Mintenance	Maputo
2	Eng ^o Luis Fernandes	ANE - DIMAN	Head of Maintenance	Maputo
3	Eng ^a Rubina Normahomed	ANE - DIMAN	Engineer DIMAN	Maputo
4	Eng ^a Raquel Langa	ANE - DIPRO	Engineer Monitoring Section	Maputo
5	Eng ^o César Macuacua	ANE - DIMAN	Engineer Road Safety	Maputo
6	Eng ^o Crimildo Mucavele	ANE - DIPRO	Engineer Projects	Maputo
7	Mr. Kenneth Mukura	TRL	Project Manager	Zimbabwe
8	Eng ^o Maria Macuacua	ANE Maputo	Engineer	Maputo
9	Dr. John Rolt	TRL	Consultant	UK
10	Mike Pinnard	TRL	Consultant	Botswana
11	Eng ^o Egídio Morais	DPANE Nampula	ANE Provincial. Delegate	Nampula
12	Eng ^o Carlos Braz	DPANE Nampula	Head of Departmant	Nampula
13	Eng ^o Faizal Salé	ECRAM	Engineer	Nampula
14	Eng ^o Alfredo	ECRAM	Engineer	Nampula
15	Eng ^o Rogerio Simione	DPANE Nampula	Engineer	Nampula
16	Eng ^o Dino da Silva	DPANE Nampula	Engineer	Nampula
17	Eng ^o Breslau Maria	DPANE Nampula	Engineer	Nampula
18	Eng ^o Daniel Machaie	DPANE Tete	ANE Provincial. Delegate	Tete
19	Eng ^a Balbina	DPANE Nampula	Engineer	Nampula
20	Eng ^o Bernadino	DPANE Tete	Engineer	Tete
21	Eng ^o			
22	Eng ^o Sérgio António Paulo	DPANE Zambézia	Engineer	Zambézia
23	Eng ^o Afonso Uamusse	DPANE Cabo Delgado	ANE Provincial. Delegate	Cabo Delgado
24	Eng ^o Alfredo C. António	DPANE Cabo Delgado	Engineer	Cabo Delgado

25	EngºFernando Dabo	DPANE Niassa	ANE Provincial. Delegate	Niassa
26	Engº Oreste M.R. Zezela	DPANE Niassa	Head of Technical Dept.	Niassa
27	Engº Florentino Raul de Sousa	DPANE - Nampula	Engineer	Nampula
28	Engº José Ismael J.Sacur	Contractor - ALM- Construções	Team Leader	Tete
29	Engº Antonio A.N.G. da Silva	Consultant - DHV- Consultor		Tete
30	Engº. Nedson Kaunda	Consultant - Scott Wilson- Zambézia	Team Leader	Zambézia
31	Engº. Alejandro Monroy	Consultant - Consultec	Team Leader	Nampula
32	Engº.Filipe Mupetse	Consultant - Consultec	Senior Inspector	Nampula
33	Engº. Jorge Chissico	Consultant - Consultec	Senior Inspector	Nampula
34	Engº. Messias	Consultant - Consultec	Senior Inspector	Nampula
35	Engº Manhiça	Consultant - Consultec	Senior Inspector	Nampula
36	Engº.Adonys C. Pérez	Consultant -Consultec- Niassa	Team Leader	Niassa
37	Engº.Amâncio T. Mabomgue	Consultant -COTOP-Cabo Delgado	Team Leader	Cabo Delgado
38	Engº Gabriel A.Siedade	Municipality of Tete	Engineer	Tete
39	Engº Carlos Portimão	District of Moatize	Engineer	Tete
40	Engº. António José Bonde	District of Quelimane	Engineer	Zambézia
41	Engº.Meque Macone Muloi	District of Nicoadala	Engineer	Zambézia
42	Engº Adelio Joaquim	Contractor -PROMER	Engineer	Nampula
43	Gilberto Botão	STV	Journalist	Nampula
44	Engº Molinde	District of Nacala - Velha	Engineer	Nampula
45	Engº Americo Arnaldo	District of Nacal-Porto	Engineer	Nampula
46	Engº.Jaime Kassele Assane	District of Lichinga	Engineer	Niassa
47	Engº.Fernando Leandro Calisto	District of Lago	Engineer	Niassa
48	Engº Dionisio	SDPI - District of Pemba	Engineer	Cabo Delgado
49	Engº Carlos A. Manhanguane	SDPI – District of Macomia	Engineer	Cabo Delgado
50	Engº Sulemane Alifo	Contractor - ECRAN	Engineer	Nampula

51		Contractor-Libombos Construções	Engineer	Nampula
52	Engº Felix Antonio Joaquim	Contractor- SMS	Engineer	Nampula
53	Engº Faustino Arlindo Damião	Contractor- TCS	Engineer	Nampula
54	Engº Miquias	Contractor- ECM	Engineer	Nampula
55	Engº Andre Celestino	Contractor-CHAID	Engineer	Nampula
56	Engº Riaz Abdul Razak	Contractor- Orathamera	Engineer	Nampula
57	Engº Armando Cruz	Contractor- Sojovi	Engineer	Nampula
58	Isidro H. Pondeca Matimbe	Contractor- Old Construções	Engineer	Tete
59	Engº Pio Matos	Contractor-Zambézia	Engineer	Zambézia
60	Engº Chawale Napana	Contractor-Zambézia	Engineer	Zambézia
61	Engº Vicente Jorge	Contractor- Sucone Construções	Engineer	Cabo Delgado
62	Engº Neves J.B Vicente	Contractor-EMACC	Engineer	Cabo Delgado
63	Engº.Januário Angelo Nhatsane	Contractor- JOP Construções	Engineer	Niassa
64	Engº.Nelson Alexandre Mota	Contractor- AC Construções	Engineer	Niassa
65	Engº Alvarinho Calton Carvalho	Contractor- AC Construções	Engineer	Niassa
66	Siteo Lutxeque	Media- Radio Encontro	Journalist	Nampula
67	Sandra Eugénio	Media- Radio Haq	Journalist	Nampula
68	Albano Xavier	Media- Radio Moçambique	Journalist	Nampula
69	Carlos Gastene	Media- STV	Journalist	Nampula
70	Virgilio	Media- @ Verdade	Journalist	Nampula
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