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Performance of Surface Treatments
in Ethiopia
Train the Trainers



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Improved Performance of Surface Treatments in Ethiopia Train the Trainers

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EXECUTIVE SUMMARY

In late 2009 a review of thin bituminous surfacing practice in Ethiopia was carried out under the African Community Access Programme (AFCAP) programme, and it was identified that the use of thin bituminous surfacings is declining due to a lack of industry confidence and a tendency towards the use of asphalt concrete. It was therefore recognised that there is a need to develop a training course in order to improve the capacity of practitioners in the design, construction and maintenance of thin bituminous surfacings.

Under the AFCAP programme, funded by the Department for International Development (DFID), the Ethiopian Road Authority (ERA) have decided to undertake a training programme with the aim of improving thin bituminous surfacing practice in Ethiopia. Roughton International (RI) were therefore contracted by Crown Agents, who are managing the AFCAP programme, to develop and deliver a series of training courses covering all aspects of design, construction and maintenance. These training courses were developed and delivered by RI in February 2012 at the Alemgena Training and Testing Centre (ATTC), and were also delivered at the ATTC in November 2011 under EU funding. The courses were delivered to three groups including operators and foremen, technicians and engineers, with a course of one week in duration for each group.

It is intended that the ATTC will adopt the training courses in thin bituminous surfacings and incorporate them into existing programmes, so that the courses may be delivered to practitioners on a regular basis. Therefore in October 2013 RI delivered a Train the Trainers course at the ATTC, which consisted of a two week programme. During the first week the training course was delivered to ATTC trainers as well as staff from the ERA Research and Development Directorate, so that the ATTC staff may familiarise with the course. In the second week, the course was handed over to the ATTC staff who then delivered the course to practitioners from Ethiopian contractors, enabling the ATTC staff to gain experience in delivering the courses.

Following completion of the Train the Trainers course, the ATTC trainers were successful in delivering the classroom modules to practitioners from local contractors, although they were unable to deliver a practical demonstration due to weather conditions. The ATTC have now gained experience and confidence in delivering the training course and will be able deliver the course in future programmes. It is felt that the ATTC staff would benefit from further assistance and training if they are to deliver practical demonstrations in future training courses.

1. INTRODUCTION

1.1 Project Background

In late 2009 AFCAP commissioned a review of thin bituminous surfacing practice in Ethiopia, including review of existing design methods and standard specifications; site visits; and interviews with government, university and industry representatives. The study signalled the critical need for practitioner training in the local industry, focusing on quality assurance, workmanship, general understanding of thin bituminous surfacings, selection of an appropriate type of seal, design methods, guidance on suitable construction equipment, construction methods, site testing and quality assurance. In addition, the consultants recommended production of a 'best practice' guideline for Ethiopia on interpretation of standards, selection of an appropriate thin bituminous surfacing, construction and maintenance.

This has now been successfully completed and training courses were implemented in November 2011 and February 2012, with support from the European Union and AFCAP. These courses are designed to enhance the skills of local practitioners in the design, construction and maintenance of thin bituminous surfacings.

The intention of AFCAP and ERA is that the training courses are fully transferred to Alemgena Training and Testing Centre (ATTC), so that the ATTC staff are able to deliver the training courses independently in the future. The intention is also that the training courses will be integrated into existing training programmes at the ATTC and will receive official accreditation under the Technical and Vocational Education and Training (TVET) system. In May 2012 during a meeting between the AFCAP Technical Services Manager and the ERA Senior Management it was decided that further training events were necessary and the Consultants staff should meet with the ERA Senior Management in order to discuss the options for further training.

Meetings between the Consultant and ERA were held from the 5 to the 9 of November 2012, in order to discuss the implementation of a 'Train the Trainers' course at the ATTC. This consisted of a one week course delivered to the ATTC training staff in October 2013, in which the training modules were presented and training materials were transferred. Time was also allocated for explanation and clarification of queries on the logistical and technical details of the course. The answering of queries was carried out in the form of group discussion, so that all training participants could benefit.

During further discussion following the meetings held in November 2012 it was requested by ERA that the Train the Trainers week is followed by an additional week for delivering the course to practitioners from local contractors. The aim of this second week of training was to provide the ATTC trainers with an opportunity to gain experience in delivering the course, with assistance from the Consultant where required.

1.2 Project Scope

The following services are to be provided:

1. Organise the training materials required for the course including notes, handouts, presentations, practical examples and exercise worksheets.
2. Conduct a one week training event for a maximum of 20 staff from the ATTC and the Research and Development Directorate of ERA. The training event will include one day of practical demonstration in the ATTC yard.
3. Assist ATTC staff to conduct a one week training event for a maximum of 50 participants from small and medium local contractors using the project training materials. The

training event will include one day of practical demonstration in the ATTC yard. The training modules will be delivered by the ATTC staff with assistance from the Consultant where required.

4. Obtain feedback from all training participants through a short questionnaire administered at the end of each course.
5. Assist ERA to prepare certificates of attendance for all participants.
6. Prepare a CD-ROM including all training materials in an easily searchable format with explanatory notes for use by the ATTC and other organisations that may wish to present the course.
7. Prepare a final report that summarises the project activities and achievements, and makes recommendations for further inputs required in order to incorporate the training programme into the ATTC curriculum.

1.3 Project Team

The RI project team consists of the following staff:

- Team Leader/Bituminous Road Surfacing Specialist I Jon Hongve
- Bituminous Road Surfacing Specialist II Harold Bofinger
- Support Engineer I Dawit Ergicho Fanta
- Support Engineer II Thomas Falconer

The head office Support Staff is as follows:

- Project Director Simon Gillett

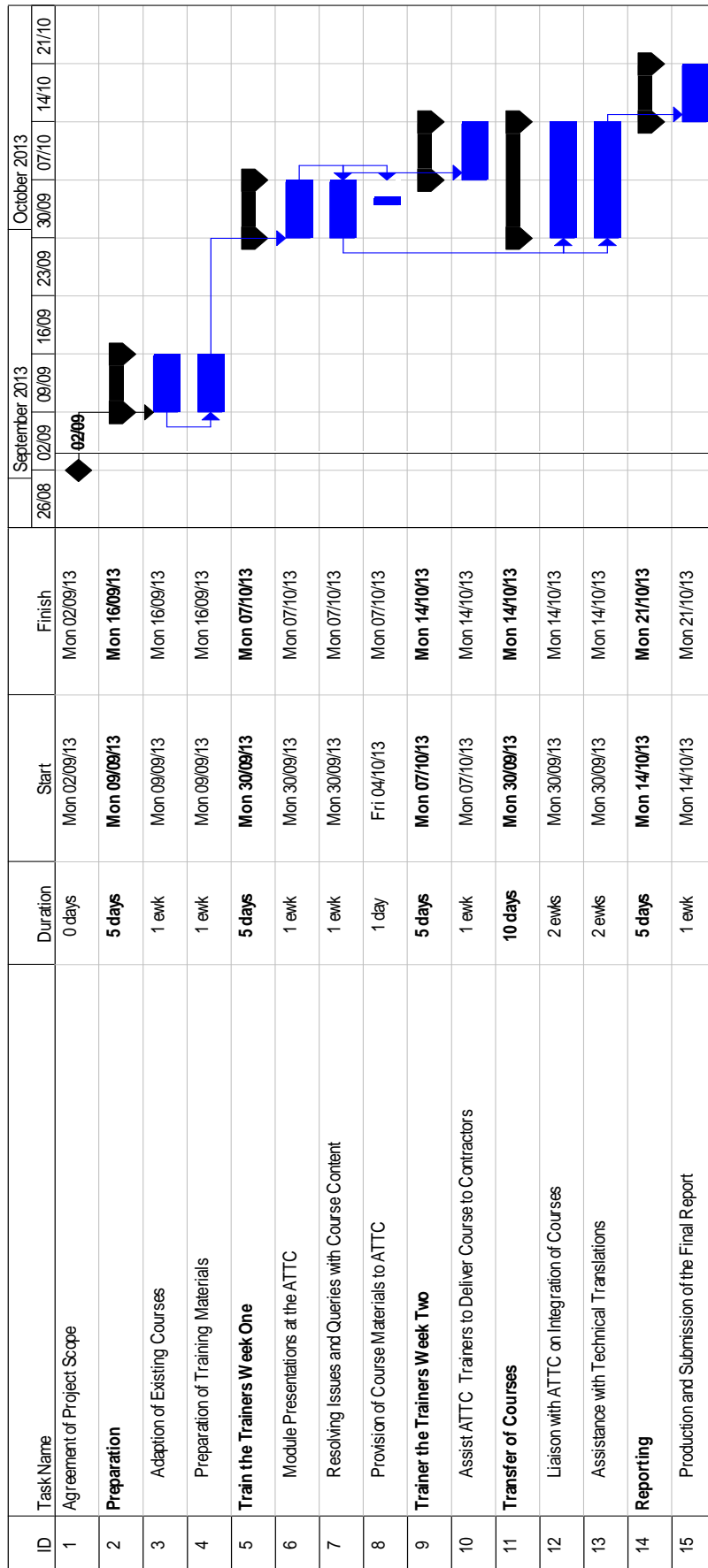
The project team was mobilised to Addis Ababa on the following dates:

- Jon Hongve 28 September 2013
- Harold Bofinger 28 September 2013
- Dawit Ergicho Fanta 28 September 2013
- Thomas Falconer 28 September 2013

1.4 Project Programme

The overall programme is shown in Figure 1-1. The Train the Trainers course was delivered from the 30 of September to the 4 of October, and the training for contractors was delivered from the 7 of October to the 11 of October.

Figure 1-1 Project Programme



1.5 Objective of this Report

The objective of this report is to summarise all project activities and achievements and make recommendations on further inputs and activities required in order to incorporate the training courses into existing programmes at the ATTC. In order to carry out this objective the report is organised into the following sections:

1. Introduction
2. Training Modules
3. Train the Trainers Course Delivery
4. Train the Trainers Participant Evaluation
5. Delivery of Training for Local Contractors
6. Training for Local Contractors Participant Evaluation
7. Conclusions
8. Recommendations

Included in the appendices to this report are aggregate test results, lists of all training participants, a copy of the participant registration form, the participant evaluation form and all worksheets included in the training materials.

2. TRAINING MODULES

2.1 Course Format

The training courses were developed in previous stages of the project during 2011 and 2012, and were laid out into modules covering all aspects of the design, construction and maintenance of thin bituminous surfacings. This enabled the courses to be delivered to three different target groups as follows:

- Foremen and Operators
- Technicians
- Engineers

This approach allows the courses to be tailored to a number of training groups at various levels and with differing training requirements.

2.2 Training Modules

Some modules are essential for all training groups whereas other modules are specific to one training group. The Engineers' course was tailored more towards design whereas the Operators and Foremen course was more focussed on practical demonstration, and the Technicians' course included laboratory work. Table 2-1 shows the format in which the modules have been delivered previously, with one week of training provided for each of the three groups.

During the Train the Trainers course all classroom modules were presented to the ATTC trainers, following the format of the Engineers' course, to enable them to familiarise with all classroom modules. Module 9 was previously delivered by ATTC laboratory technicians and therefore was not required during the Train the Trainers course. More detail on the content of each Module is given in Section 3.2.

Table 2-1 List of the Training Modules

Module No.	Topic/Content	Engineers	Technicians	Foremen and Operators
1	Registration of Participants	✓	✓	✓
2	Introduction to Thin Bituminous Surfacing	✓	✓	✓
3	Safety and First Aid	✓	✓	✓
4	Design of Thin Bituminous Surfacing	✓		
5	Materials	✓	✓	✓
6	Equipment	✓	✓	✓
7	Construction of Thin Bituminous Surfacing	✓	✓	✓

Module No.	Topic/Content	Engineers	Technicians	Foremen and Operators
8	Supervision and Quality Control	✓	✓	
9	Testing and Quality Control – laboratory work		✓	
10	Surface Dressing Demonstration – on-site training	✓	✓	✓
11	Operation and Maintenance of Equipment - in-yard training			✓
12	Fault avoidance and corrective procedures			✓
13	Evaluation and Closing	✓	✓	✓

3. TRAIN THE TRAINERS COURSE DELIVERY

3.1 Training Timetable

The training timetable as delivered is shown in Table 3-1. Small adjustments were made to the original timetable as necessary during the training, as some modules required extra time in order to cover all queries raised by the training participants.

Table 3-1 Train the Trainers Timetable

Start Times	Monday	Tuesday	Wednesday	Thursday Site Visit	Friday
09.00	Module 1	Module 4	Module 4	Module 6	Module 7
10.30	Break	Break	Break	Break	Break
11.00	Module 2	Module 4	Module 4	Module 7	Module 8
12.30	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
13.30	Module 3	Module 4	Module 5	Module 10	Worksheet
15.00	Break	Break	Break	Break	Break
15.30	Module 3	Module 4	Module 6	Module 10	Evaluation
17:00	End of day	End of day	End of day	End of day	End of day

3.2 Classroom Training

3.2.1 Module 1 Registration

Module 1 was delivered by Thomas Falconer on Monday 30 of September 2013. During this module the training participants were registered and requested to complete the registration form, providing their full names, employment details, language ability and level of experience. The training participants were then given an introduction to the RI team, and were invited to discuss their previous experience of thin bituminous surfacings and their current projects.

3.2.2 Module 2 Introduction to Thin Bituminous Surfacing

Module 2 was delivered by Thomas Falconer on Monday 30 of September. This module provides an overview of the various types of thin bituminous surfacing, their advantages and disadvantages and when they are appropriate for use. The training participants were invited to discuss the types of thin bituminous surfacing that they have previously come across. Some had previous experience with surface dressing, and a small number had an awareness of Otta seals.

3.2.3 Module 3 Safety and First Aid

Module 3 was delivered by Thomas Falconer on Monday 30 of September, and included guidance on the safety requirements of the ERA specification, safety during the handling of hot bitumen, fire fighting measures, first aid measures, the proper use of Personal Protective Equipment (PPE) and traffic safety. Following the PowerPoint presentation participants were shown the Sabita DVD 430 'Working Safely with Bitumen', and the Sabita DVD 420 on 'Treatment of Bitumen Burns'. The module was ended with a question and answer session on safety issues, in which the participants were actively engaged.

3.2.4 Module 4 Design of Thin Bituminous Surfacing

Module 4 was delivered by Harold Bofinger and Jon Hongve on Tuesday 1 of October and Wednesday 2 of October, covering design life and maintenance requirements, survey and data collection, repair of pavement defects and other preliminary works, selection of surface treatment type, design of surface dressings according to Overseas Road Note (ORN) 3, traffic surveys, measurement of road surface hardness, selection and properties of chippings, selection of binder type, determination of bitumen spray rate, estimation of material quantities, additives and modifiers, design of slurry seals, cape seals and Otta seals. This module required some extra time in order to fully explain all aspects of the design of the different types of thin bituminous surfacing and the varying design requirements.

3.2.5 Module 5 Materials

Module 5 was delivered by Harold Bofinger on Wednesday 2 of October. This module covers the various kinds of binder that are used in thin bituminous surfacings including penetration grade bitumen, cut backs and emulsions. The various specification requirements that aggregates must meet were explained including grading, hardness, abrasion resistance, soundness, polished stone value and bitumen affinity.

3.2.6 Module 6 Equipment

Module 6 was delivered by Jon Hongve on Wednesday 2 of October and Thursday the 3 of October as shown in Figure 3-1, providing a description of the equipment that is required to construct thin bituminous surfacings. This includes the different types of bitumen distributor, spraybars, bitumen heaters, chipping spreaders, rollers and calibration of equipment.

Figure 3-1 Classroom Training



3.2.7 Module 7 Construction of Thin Bituminous Surfacing

Module 7 was delivered by Harold Bofinger and Jon Hongve on Thursday the 3 of October and Friday the 4 of October. This module covers equipment and materials, preparation of the existing pavement, application of the prime coat, construction of a double surface dressing, construction of double sand seals, slurry seals, cape seals, Otta seals and cold mix asphalt.

3.2.8 Module 8 Quality Control and Supervision

Module 8 was delivered by Harold Bofinger on Friday the 4 of October. This module gives guidance on materials acceptance tests, aggregate grading, flakiness index, average least dimension (ALD), Los Angeles abrasion value, aggregate strength tests, the polished stone value (PSV), aggregate soundness, adhesion of bitumen to aggregate, viscosity of cut back binders and emulsions, penetration testing and quality control measures in the field.

Following the presentation the participants were shown the Sabita DVD 100 'Standard tests for bituminous products', which involved the penetration test, the ring and ball softening point test, the ductility test and the Brookfield viscosity test.

3.3 Practical Demonstration

The practical demonstration was carried out on Thursday 3 of October in the ATTC compound. Following formal request to the ATTC equipment and materials were provided including a bitumen distributor, pneumatic tyred roller, compressed air blower, electronic balance, steel trays, wooden trays, MC 3000 bitumen and 10 mm chippings. Grading and flakiness test results are shown in Appendix A. The chipping spreader was provided, but the operator for this machine was not available.

Due to heavy rains during the week, the aggregate provided for the practical demonstration was wet and it was not possible to apply a surface dressing. The calibration of the bitumen distributor was carried out and demonstrated to the participants, with the intention of carrying out the application of a surface dressing in the following week. Appropriate Personal Protective Equipment (PPE) was provided to the participants by the ATTC.

The demonstration began with the transverse spray test using steel trays as shown in Figure 3-3, in order to ensure that the spray across the spray bar is even within $\pm 5\%$. The results showed that the transverse distribution of the spray bar was close to the specification, as the net weight of almost all trays was within $\pm 5\%$ from the mean. It is considered that the transverse distribution would improve when the spray bar reached the specified spraying temperature. The results are illustrated in Figure 3-2.

Figure 3-2 Results of the Transverse Distribution Test

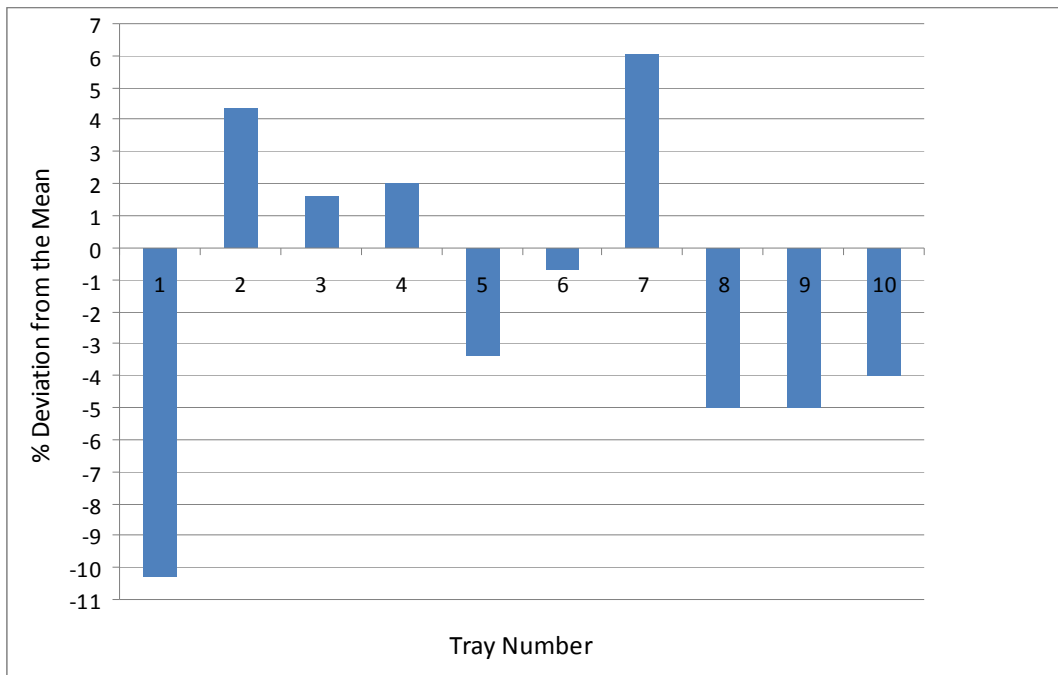


Figure 3-3 Transverse Spray Test



Following the transverse distribution test a longitudinal spray test was carried out as shown in Figure 3-5, using wooden trays. This test was carried out in order to calibrate the spray rate of the distributor at two different road speeds when a volume of 294 litres per minute was pumped through 21 nozzles, to determine the number of nozzles needed to produce the width of spray required, and to determine if the road speed needs to be reduced or increased in order to give the correct spray rate. The results of two of these tests are shown in Table 3-2 and Table 3-3. The Revolutions per Minute (RPM) for the pump was set for 21 nozzles to give a spray rate of 1.0 l/m² at a road speed of 93 m/min, using the theoretical pump output read from chart that is provided with the distributor. It was then realised that 25 nozzles were being used, a correction factor of 25/21 = 1.19 was therefore applied to the spray rate.

Table 3-2 Results of Longitudinal Test at Road Speed 85 m/min

Tray Number	1	2	3	4	5
Full Tray Weight, kg	1.197	1.118	1.128	1.135	1.132
Tray Weight, kg	1.004	0.927	0.939	0.949	0.936
Bitumen Weight, kg	0.193	0.191	0.189	0.186	0.196
Tray Area, m ²	0.25	0.25	0.25	0.25	0.25
Spray Rate, Kg/m ²	0.77	0.76	0.76	0.74	0.78
Correction Factor	1.19	1.19	1.19	1.19	1.19
Corrected Spray Rate, Kg/m²	0.92	0.91	0.90	0.89	0.93

Table 3-3 Results of Longitudinal Test at Road Speed 115 m/min

Tray Number	6	7	8	9	10
Full Tray Weight, kg	1.083	1.054	1.056	1.076	1.036
Tray Weight, kg	0.948	0.918	0.914	0.933	0.891
Bitumen Weight, kg	0.135	0.136	0.142	0.143	0.145
Tray Area, m ²	0.25	0.25	0.25	0.25	0.25
Spray Rate, Kg/m ²	0.54	0.54	0.57	0.57	0.58
Correction Factor	1.19	1.19	1.19	1.19	1.19
Corrected Spray Rate, Kg/m²	0.64	0.65	0.68	0.68	0.69

These tests showed that the pump output is lower than that shown on the chart that is provided with the distributor. After two longitudinal spray tests were carried out at different speeds, it was possible to produce a graph in order to plot road speed against spray rate. The correct road speed for the required spray rate can then be read from the graph shown in Figure 3-4. It was also necessary to make adjustments to the height of the spray bar and the spray pressure in order to achieve an even spray.

Figure 3-4 Plot of Road Speed against Spray Rate

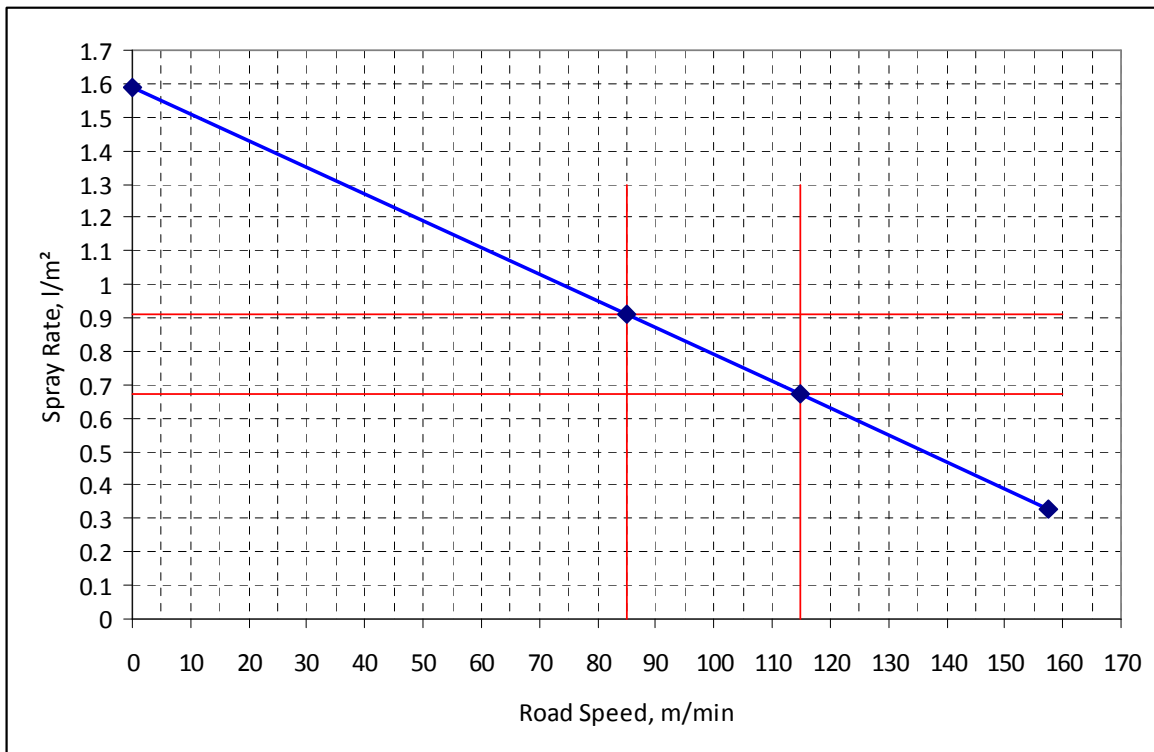


Figure 3-5 Longitudinal Spray Test



3.4 Transfer of Training Materials

The course training materials were officially handed over to Ato. Hailu Chekun, Manager of the ATTC, and Ato. Aman Tesfaye, Deputy Manager, on Thursday the 3 of October 2013. The course materials handed over included 50 hard copies of the training handout, including all module presentations, worksheets and notes. In addition, 10 DVD soft copies of training materials were handed over including a soft copy of the training handout booklet in pdf, PowerPoint copies of all presentations, manuals and specifications and videos.

3.5 Certificates

Certificates of attendance have been printed and are to be signed by the Director General of ERA.

4. TRAIN THE TRAINERS PARTICIPANT EVALUATION

4.1 Registration

A total of 28 participants registered on the course and a full list of the participants is provided in Appendix B. A daily attendance record was kept by RI each morning and afternoon. Amongst the participants were the four ATTC trainers who were appointed to deliver the course in the following week. The remainder of the participants came from ERA and the Ethiopian Road Construction Corporation (ERCC). There were also a small number of participants from private sector consultants. The registration questionnaire filled in by participants is given in Appendix C.

4.2 Participant Registration Questionnaires

4.2.1 Job Title

The percentage of participants with each job title is shown in Table 4-1.

Table 4-1 Job Titles

Job Title	Percentage of Participants
Engineer	43
Material Inspector	4
Foremen	32
Surveyor	4
Trainer	7
Researcher	11

4.2.2 Type of Employer

The percentage of participants coming from each type of employer is shown in Table 4-2. The participants who came from a Contractor were from the ERCC and those who came from a government employer were from ERA.

Table 4-2 Types of Employer

Type of Employer	Percentage of Participants
Contractor	32
Consultant	11
Government Contractor	57

4.2.3 Language

The percentage of participants rating their English language ability at each level, from 0 to 5, is shown in Table 4-3. All participants were fluent in Amharic.

Table 4-3 English Language Ability

English Language Ability, %					
0	1	2	3	4	5
4	0	0	25	25	46

4.2.4 Experience

The percentage of participants having 0, 1, 2, 3, 4, 5, 6, or 7+ years of experience working for their current company and working in roadworks is shown in Table 4-4 and Table 4-5.

Table 4-4 Years Spent at Current Company

Years Spent Working for Current Company							
0	1	2	3	4	5	6	7+
0	11	21	4	11	0	7	46

Table 4-5 Years of Experience in Roadworks

Years of Experience in Roadworks							
0	1	2	3	4	5	6	7+
0	11	18	7	11	7	7	39

4.3 Participant Evaluation Questionnaires

At the end of the course the participants were requested to fill out an evaluation questionnaire, shown in Appendix D.

4.3.1 Pre-course Briefing

Participants were asked if they received a pre-course briefing from their manager, 82% answered yes and 18% answered no.

4.3.2 Relevance to Job

Participants were asked to indicate the extent to which they felt that the training was relevant to their job by circling an appropriate rating from 1 to 5, with 1 indicating that the training was not relevant to their job at all and 5 indicating that the training was highly relevant to their job. Table 4-6 shows the percentage of participants that circled each rating from 1 to 5.

Table 4-6 Practical Relevance to Job

Relevance to Job				
1	2	3	4	5
6	6	12	18	59

4.3.3 Training Methods

Participants were asked to rate the usefulness of the training methods shown in Table 4-7 in the development of their understanding and skills by circling the appropriate rating, with 1 indicating that the training method is of no use and 5 indicating that it is of great use. The participants responded very positively when rating presentation sessions, with 4 or 5 given by all participants. Wider spreads of ratings are seen for the Practical exercises, group discussions and case studies, though participants still responded positively. This table also illustrates the importance of handouts and videos to the participants.

Table 4-7 Participant Rating of Training Methods

Method	Rating from 1 to 5, %				
	1	2	3	4	5
Tutor/presentations	0	0	0	18	82
Group discussions	6	11	17	33	33
Case studies	0	0	24	41	35
Practical exercises	0	6	18	35	41
Videos/DVDs	0	6	6	18	71
Handouts	6	0	12	6	76

4.3.4 Training Sessions

Participants were asked to rate the quality of each of the training modules in the development of their understanding and skills by circling the appropriate rating, with 1 indicating that each training module is of low quality and 5 indicating that it is of high quality. Table 4-8 indicates the percentage of participants assigning each score to each module, and shows that the quality of the modules was considered high by the participants. A greater spread is seen in the ratings for the practical demonstration.

Table 4-8 Participant Rating of Training Methods

Method	Rating from 1 to 5, %				
	1	2	3	4	5
1. Registration	0	0	0	12	88
2. Introduction	0	0	0	18	82
3. Safety and First Aid	6	0	6	24	65
4. Design	0	6	18	29	47
5. Materials	0	0	6	41	53
6. Equipment	0	0	12	41	47
7. Construction	0	6	6	47	41
8. Quality Control	0	6	6	41	47
10. Practical Demonstration	6	0	35	29	29

4.3.5 Facilities and Administration

Participants were asked to indicate their rating of the quality of the facilities and administration during the training by circling the appropriate rating from 1 to 5, with a rating of 1 indicating low quality and a rating of 5 indicating high quality. Table 4-9 gives the participant ratings.

Table 4-9 Participant Rating of Facilities and Administration

Method	Rating from 1 to 5, %				
	1	2	3	4	5
Training Rooms	0	6	6	24	65
Catering	6	12	18	29	35
Accommodation	12	6	24	24	35
Joining Instructions	6	0	12	41	41
Timeliness	6	0	12	29	53
Adequacy	6	0	18	41	35
Handling of any Enquiries	6	0	12	41	41

4.3.6 General Comments

Participants were asked to add any general comments which may help to improve the quality of the training experience, in terms of meeting participant expectations and needs, making the programme more relevant to their job and providing a better quality of training and facilities. In general the participants felt positively about the course, and stated that they would prefer a higher proportion of group discussion and practical demonstration.

4.4 Worksheet Evaluation

The training participants successfully carried out a worksheet on the construction of surface dressings. Most participants completed the worksheet fully, accurately and correctly. A copy of the worksheets included in the training materials is shown in Appendix E.

5. DELIVERY OF TRAINING FOR LOCAL CONTRACTORS

5.1 Course Timetable

The training timetable as delivered is shown in Table 5-1. There was some modification to the original timetable due to unforeseen conditions that were encountered during the first day of the week, relating to the attendance of suitable participants. In order to use this day effectively RI and ATTC staff undertook some one-to-one discussion on issues related to the delivery of the classroom modules and on the proper use and calibration of equipment.

Table 5-1 Training for Contractors Timetable

Start Times	Monday	Tuesday	Wednesday	Thursday Site Visit	Friday
09.00	Discussion with ATTC Staff	Module 1	Module 4	Module 5	Module 7
10.30	Break	Break	Break	Break	Break
11.00	Discussion with ATTC Staff	Module 2	Module 4	Module 5	Module 8
12.30	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
14.00	Discussion with ATTC Staff	Module 3	Module 4	Module 6	Module 8
15.30	Break	Break	Break	Break	Break
15.30	Discussion with ATTC Staff	Module 4	Module 4	Module 7	Worksheet & Evaluation
17:00	End of day	End of day	End of day	End of day	End of day

5.2 ATTC and ERA Research Staff

The following staff from the ATTC undertook the delivery of the training:

- Yonas Hailu (from ATTC) Lecturer
- Asmera Nassir (from ERA Research) Engineer at ERA Research
- Addisu Tafesse (from ATTC) Lecturer
- Woinshet Fetene (from ERA Research) Lecturer

The training was carried out with the assistance of the RI trainers.

5.3 Classroom Training

The classroom training was delivered by ATTC and ERA Research staff as shown in Figure 5-1. The classroom training was delivered in a combination of Amharic and English, as per the normal method of course delivery at the ATTC.

Figure 5-1 Classroom Training

5.3.1 Module 1 Registration

Module 1 was delivered by Yonas Hailu on Tuesday 8 of October 2013. During this module the training participants were registered and requested to complete the registration form, providing their full names, employment details, language ability and level of experience.

5.3.2 Module 2 Introduction to Thin Bituminous Surfacing

Module 2 was delivered by Yonas Hailu on Tuesday 8 of October 2013. Some of the participants had attended the previous week of training and most had experience and knowledge of the various types of thin bituminous surfacing presented in this module. There was discussion on the advantages and disadvantages of the various types of surfacing and when they are appropriate for use. RI staff had to provide only minimal assistance during the module delivery and discussion by clarifying questions raised by the training participants. This module was conducted entirely in English and queries by participants were also made in English.

5.3.3 Module 3 Safety and First Aid

Module 3 was delivered by Woinshet Fetene on Tuesday 8 of October 2013, and included guidance on the safety requirements of the ERA specification, safety during the handling of hot bitumen, fire fighting measures, first aid measures, the proper use of Personal Protective Equipment (PPE) and traffic safety. Following the PowerPoint presentation participants were shown the Sabita DVD 430 'Working Safely with Bitumen'.

5.3.4 Module 4 Design of Thin Bituminous Surfacing

Module 4 was delivered by Asmera Nassir on Tuesday 8 of October and Wednesday 9 of October, covering design life and maintenance requirements, survey and data collection, repair of pavement defects and other preliminary works, selection of surface treatment type, design of

surface dressings according to Overseas Road Note (ORN) 3, traffic surveys, measurement of road surface hardness, selection and properties of chippings, selection of binder type, determination of bitumen spray rate, estimation of material quantities, additives and modifiers, design of slurry seals, cape seals and Otta seals. This module required some extra time in order to fully explain all aspects of the design of the different types of thin bituminous surfacing and the varying design requirements. RI staff provided support by providing further clarification at intervals and when requested by the ATTC trainer, as well as when issues requiring further clarification were raised by the trainees. There was good participation from the trainees and the ATTC trainer conducted the module delivery well.

5.3.5 Module 5 Materials

Module 5 was delivered by Addisu Tafese on Thursday 10 of October. This module covers the various kinds of binder that are used in thin bituminous surfacings including penetration grade bitumen, cut backs and emulsions. The various specification requirements that aggregates must meet were explained including grading, hardness, abrasion resistance, soundness, polished stone value and the properties and testing of bitumens. There was good participation from the trainees and the ATTC trainer conducted the module delivery very well.

The SABITA DVD, 'Standard tests for bituminous products' was shown during this session. Almost the entire presentation was made in Amharic. It was well received and understood by the participants who made a major contribution to the discussion. No assistance was required from the RI staff during the presentation or the discussions which followed.

5.3.6 Module 6 Equipment

Module 6 was delivered by Yonas Hailu on 10 of October 2013. There was good interaction and discussion from the participants during the module delivery and RI staff assisted in clarifying some of the questions raised by the participants. The presentation was conducted mainly in English with discussion mostly in Amharic.

5.3.7 Module 7 Construction of Thin Bituminous Surfacing

Module 7 was delivered by Yonas Hailu and Asmera Nassir on 10 and 11 of October 2013. As most of the participants were foremen there was high level of interest and trainees raised a number of questions, which were addressed by both the ATTC trainers and RI staff. The main emphasis in the presentation was the construction of surface dressings and it appeared that, initially, a few participants were reluctant to accept that surface dressings could perform very well and cost significantly less than asphalt concrete. The presentation was conducted mainly in English with discussion mainly in Amharic.

5.3.8 Module 8 Quality Control and Supervision

Module 8 was delivered by Yonas Hailu on 11 of October 2013. This module gives guidance on materials acceptance tests, aggregate grading, flakiness index, average least dimension (ALD), Los Angeles abrasion value, aggregate strength tests, the polished stone value (PSV), aggregate soundness, adhesion of bitumen to aggregate, viscosity of cut back binders and emulsions, penetration testing and quality control measures in the field. The module was well presented, primarily in English. Yonas handled most of the questions skilfully but did not hesitate to ask for some assistance from RI staff when difficult questions were asked by the engineers in the group.

5.4 Practical Demonstration

It was impossible to conduct the practical demonstration as planned due to the rainy weather conditions. RI staff provided practical guidance to enable the ATTC trainers to conduct the practical demonstrations when conditions allow.

During the second week, additional aggregate was brought to the ATTC. The median grain size of this aggregate was 7mm and it had a flakiness index of 18.9%, giving an ALD of 5.2mm on which to base the bitumen spray rate. The grading table for this aggregate is given in Table 5-2.

Table 5-2 Aggregate Grading

Sieve Designation	Weight Retained (gm)	Percent Retained	Percent Passing
12.5 mm	0	0	100
9.5 mm	276	7.75	92.25
6.3 mm	1921	53.93	38.32
4.75 mm	1106	31.05	7.27
2.36 mm	245	6.88	0.39
1.18 mm	4	0.11	0.28
No 30 (0.600 mm)	1	0.03	0.25
No 40 (0.425 mm)	0	0	0.25
No 200 (0.075 mm)	3	0.08	0.17
Pan	6	0.17	0
Total	3562		

5.5 Certificates

Certificates of attendance have been printed and are to be signed by the Director General of ERA.

6. TRAINING FOR LOCAL CONTRACTORS PARTICIPANT EVALUATION

6.1 Registration

A total of 28 participants registered on the course and a full list of the participants is provided in Appendix B. A daily attendance record was kept each morning and afternoon.

92 % of the participant came from Government Contractors while 8 % of them came from local small contractors.

6.2 Participant Registration Questionnaires

6.2.1 Job Title

The percentage of participants with each job title is shown in Table 6-1.

Table 6-1 Job Titles

Job Title	Percentage of Participants
Engineer	31
Material Inspector	0
Foremen	69
Surveyor	0
Trainer	0
Researcher	0

6.2.2 Type of Employer

The percentage of participants coming from each type of employer is shown in Table 6-2.

Table 6-2 Types of Employer

Type of Employer	Percentage of Participants
Contractor/Self-Employed	8
Consultant	0
Government Contractor	92

6.2.3 Language

The percentage of participants rating their English language ability at each level, from 0 to 5, is shown in Table 6-3. All participants were fluent in Amharic.

Table 6-3 English Language Ability

English Language Ability, %					
0	1	2	3	4	5
0	3	0	35	35	27

6.2.4 Experience

The percentage of participants having 0, 1, 2, 3, 4, 5, 6, or 7+ years of experience working for their current company and working in roadworks is shown in Table 6-4 and Table 6-5.

Table 6-4 Years Spent at Current Company

Years Spent Working for Current Company							
0	1	2	3	4	5	6	7+
7	11	4	8	0	5	0	65

Table 6-5 Years of Experience in Roadworks

Years of Experience in Roadworks							
0	1	2	3	4	5	6	7+
8	8	4	11	0	0	0	69

6.3 Evaluation Questionnaires

6.3.1 Pre-course Briefing

Participants were asked if they received a pre-course briefing from their manager, 91% answered yes and 9% answered no.

6.3.2 Relevance to Job

Participants were asked to indicate the extent to which they felt that the training was relevant to their job by circling an appropriate rating from 1 to 5, with 1 indicating that the training was not relevant to their job at all and 5 indicating that the training was highly relevant to their job. Table 6-6 shows the percentage of participants that circled each rating from 1 to 5.

Table 6-6 Practical Relevance to Job

Relevance to Job				
1	2	3	4	5
0	5	18	18	59

6.3.3 Training Methods

Participants were asked to rate the usefulness of the training methods shown in Table 6-7 in the development of their understanding and skills by circling the appropriate rating, with 1 indicating that the training method is of no use and 5 indicating that it is of great use.

Table 6-7 Participant Rating of Training Methods

Method	Rating from 1 to 5, %					Not Used
	1	2	3	4	5	
Tutor/presentations	0	0	0	32	68	0
Group discussions	0	5	0	50	32	14
Case studies	5	9	23	14	45	4
Practical exercises	9	14	0	32	27	18
Videos/DVDs	0	0	5	41	50	4
Handouts	0	0	0	23	73	4

6.3.4 Training Sessions

Participants were asked to rate the quality of each of the training modules in the development of their understanding and skills by circling the appropriate rating, with 1 indicating that each training module is of low quality and 5 indicating that it is of high quality. The results are shown in Table 6-8.

Table 6-8 Participant Rating of Training Methods

Method	Rating from 1 to 5, %				
	1	2	3	4	5
1. Registration	0	9	9	14	68
2. Introduction	0	4	14	18	64
3. Safety and First Aid	9	8	5	23	55
4. Design	5	9	14	27	45
5. Materials	9	0	0	27	64
6. Equipment	0	5	18	22	55
7. Construction	0	5	22	9	64
8. Quality Control	9	9	9	23	50

6.3.5 Facilities and Administration

Participants were asked to indicate their rating of the quality of the facilities and administration during the training by circling the appropriate rating from 1 to 5, with a rating of 1 indicating low quality and a rating of 5 indicating high quality. Table 6-9 gives the participant ratings.

Table 6-9 Participant Rating of Facilities and Administration

Method	Rating from 1 to 5, %				
	1	2	3	4	5
Training Rooms	0	0	13	23	64
Catering	4	5	23	23	45
Accommodation	4	5	18	23	50
Joining Instructions	9	6	17	24	44
Timeliness	0	6	6	21	67
Adequacy	0	2	8	30	60
Handling of any Enquiries	4	5	14	22	55

6.3.6 General Comments

General comments on the participant evaluation forms indicate that the participants were in general pleased with the training that they received. As expected there were also comments stating that practical demonstrations should be included in the training, which was not possible due to prohibitive weather conditions.

6.4 Worksheet Evaluation

The training participants successfully carried out a worksheet that covers Module 5, 6 and 7. Almost all of the participants returned the worksheet for evaluation and approximately 40% of the participants scored 75% and above. A copy of the worksheets included in the training materials is shown in Appendix E.

7. CONCLUSIONS

7.1 Train the Trainers Course

The Train the Trainers course has been carried out successfully and participants were generally pleased with the training that they received. The participants actively engaged with the RI staff and were keen to ask questions and discuss their experiences. The successful completion of worksheets by the participants also showed that they had taken on board the main points of the training.

As in previous phases of the training the chief difficulties lie with the practical demonstrations, as there is little time to solve any problems with equipment and materials due to the tight schedule in which the training is carried out. An additional difficulty is the overall co-ordination of the practical demonstrations, the ATTC staff did not appear to be aware of the materials and equipment that are required and had not received the necessary formal requests. However, the demonstration of calibrating the bitumen distributor during the first week was a useful exercise.

During the Train the Trainers week the four ATTC staff designated to take over the course attended in full and actively engaged with the RI trainers. Alongside the handover of training materials on Thursday 3 of October, discussion was held with the ATTC staff regarding the requirements and the method of delivery for each training module.

7.2 Training for Local Contractors

The classroom training modules were successfully delivered by the ATTC staff and they have gained familiarity with the modules as well as experience in delivering them. It is now felt by the RI team and the ATTC that the ATTC trainers are now able to deliver the training courses independently in future programmes and will also be able to make any small modifications necessary in order to incorporate the course into existing programmes.

The presentations made by ATTC and ERA Research staff were very good. They handled most of the questions raised by participants without difficulty but they found it more difficult to answer a few of the questions that would have been easier if they had more experience with the design and construction of surface dressings.

During the second week there were difficulties on the first day of the training with a lack of attendance of suitable participants. However this provided the RI team and ATTC staff with an opportunity to conduct one-to-one discussion on issues related to classroom course delivery so that the ATTC trainers were better prepared to deliver the modules during the week. The second difficulty encountered during the second week was that the weather conditions prevented the delivery of a practical demonstration. This difficulty is mainly attributed to the short length of the course as this means that there is only a very tight time slot in which the practical demonstrations can be carried out, this problem will be mitigated when the courses are delivered as part of longer programmes.

8. RECOMMENDATIONS

8.1 Future Training Courses

Following successful transfer of the course to the ATTC staff, the intention of the ATTC is that the training course in thin bituminous surfacing will be delivered two to three times per year, as part of wider training programmes. The training will be delivered to public sector practitioners from ERA and the Rural Road Authorities, as well as private sector practitioners from consultants and contractors. This forms part of ERA's long term objective of improving capacity in thin bituminous surfacings in the Ethiopian industry.

Across the whole of Ethiopia the Rural Road Access Programme (URRAP), funded by the Ethiopian government, is currently in progress. This programme consists of the construction of a number of gravel roads across the country in order to improve access for rural communities, and the intention of ERA is that the construction of a number of low cost, bituminous surfaced roads will follow. It is therefore essential that the ATTC now becomes fully confident in the delivery of the training in thin bituminous surfacings, so that practitioners within the industry will be suitably prepared when the envisaged construction of low cost, bituminous surfaced roads has commenced.

In order to gain practical skills in the construction of thin bituminous surfacings it is recommended that trainees spend significant time gaining experience on project sites where thin bituminous surfacing work is being carried out, in conjunction with the classroom training at the ATTC. This is believed to be the most effective approach to achieving gradual improvement in the quality of thin bituminous surfacings in Ethiopia. During meetings held between the 5 and 9 November 2012 the possibilities of long-term practical training were discussed; this would involve training on project sites for periods of around 3 months for small groups of trainees. Over a 2 to 3 year period a number of project sites in Ethiopia or in nearby African countries can be designated for trainees to gain this practical experience, under future programmes such as the next phase of AFCAP or future URRAP schemes.

In parallel to this training ERA has contracted the International Labour Organization to compile a Training Manual on thin bituminous surfacing by labour based methods. The manual was completed in June 2013 with the intention to follow-up with training in the application of the surfacing techniques using emulsions. Since emulsions can also be used for the conventional mechanized thin bituminous surfacing and will eliminate the hazards of working with hot bitumen, it is recommended that ERA make serious investigations into the possibility of making emulsions available in Ethiopia.

8.2 Further Training Materials

As per request from the ATTC, it is recommended that the ATTC trainers are provided with a wider range of training videos that can be integrated into the course. Particularly useful would be the provision of video media related to the practical demonstration, showing in more detail all aspects of construction as well as the calibration procedures for the bitumen distributor and other equipment. These videos should highlight the care and techniques required to carry out each run of the distributor on the proper line, the correct overlap between runs and sharp cut off lines at the start and finish of each run would also be particularly useful. These videos would be particularly useful for construction foremen and site engineers.

8.3 Equipment

A chief recommendation is that all equipment available at the ATTC must be regularly maintained and kept in good condition, so that successful practical demonstrations can be carried out. Some important considerations in the maintenance of equipment are as follows:

- The bitumen distributor must not be leaking oil, fuel or bitumen.
- All dials and gauges on the bitumen distributor must be in working condition and kept clean, so that they can be easily read.
- All nozzles on the distributor must be regularly cleaned so that they do not become blocked.
- On the chipping spreader the rollers of the distribution bins and the support bearings to the roller drum must be kept in good condition.
- The conveyor belts on the chipping spreader must be kept in good condition.

It must be ensured that several operators at the ATTC are fully trained in the use of the distributor, the proper use of the burners and pumps as well as the restrictions which apply when heating binders in the tank. They must be fully aware of the maintenance requirements, and must continually maintain the equipment in excellent working order. This will ensure that the bitumen in the tank retains its properties, the expected service life of the equipment is achieved and that very few problems are caused by faults in the distributor.

It is understood that almost all of the crushers in Ethiopia are jaw crushers. While these can be used for primary crushing, the secondary crushers should be selected to produce better-shaped aggregate. This is important for base and asphalt concrete materials but is even more important for the production of chippings for surface dressings. It is recommended that crushing contractors should be encouraged to use impact crushers or another type of secondary crusher which produces well-shaped aggregate. Advice from a crushing expert should be sought.

Investigations could also be made into the possibility of acquiring mobile crushers, what types of mobile crushers that are available in the market and their cost and capacity. For construction sites in remote areas far from established crushers, use of mobile crushers may be a cost effective solution.

At the present time distributors are not certified in Ethiopia. It is recommended that a testing centre is established to test and certify all distributors each year, to ensure that they have all the instrumentation required, that the spray bar will deliver bitumen evenly across its full width and that the slow speed measurement is accurate. This establishment would ensure that distributors are continually maintained to a good standard and that they are in working order.

8.4 Further Inputs from the Consultant

The ATTC staff stated that they would like an additional training programme that focuses on the practical demonstration, and especially on equipment calibration and fault avoidance. It is recommended that this is carried out in the future in order to enable the ATTC to conduct the practical demonstrations fully and confidently. This would be much better conducted in the dry season when interruptions from rain would be unlikely.

Appendix A Aggregate Test Results

ETHIOPIAN ROADS AUTHORITY
Alemgna Machine Based Technology Training Center
Grain Size Analysis

Sieve Designation	Wt Retained		% Retained		% Pass	Specification
	Individual	Cumulative	Cumulative	Indivi		
(2.5.0mm)						
(19 mm)						
(12.5mm)						
3/8" (9.5mm)		674	26.473	26.5	73.527	
No 4 (4.75mm)	1822 gm	2496	98.036	71.6	1.964	
No 8 (2.36mm)	39gm	2535	99.568	1.53	0.432	
NO 10 (2mm)						
No 6 (1.18mm)	7gm	2542	99.843	0.28	0.157	
No 20 (850mm)						
NO30(600mm)						
NO40(425mm)						
NO 50(300mm)	1 gm	2543	99.882	0.04	0.118	
NO 100(150mm)	1 gm	2544	99.921	0.04	0.079	
No200(75mm)	2 gm	2546	100	0.08	0	
PAN						
TOTAL	2546					

$$\text{Cumulative \% Retained} = \frac{\text{Cumulative Retained} * 100}{\text{Total Individual Wt Retained}}$$

$$\% \text{ Individual Retained} = \frac{\text{individual Wt Retained} * 100}{\text{Total}}$$

$$\text{Fineness Modulus} = \frac{\text{Cumulative \% Retained}}{100}$$

Prepared By

Liza Kassahun



ETHIOPIAN ROADS AUTHORITY
Alemgna Machine Based Technology Training Center
Flakiness Index Test

Sieve Size	Weight retained	retained %	Passing %
63			
50			
37.5			
28			
20			
14(12.5)			
10(9.5)	317	17.73	82.91
6.3	1115	62.36	19.91
Pass 6.3	356	19.91	0
Total			
M1	1788		
M2	1432		

Thickness Gauge ; Width Of Solt)	Weight Of Aggregate Passed through The Gauge(GM)	Weight Of Aggregate Passed through The Gauge(GM)
50-37.5		
37-25		
25-19.5		
19.5-12.5		
12.5-9.5	149	168
9.5-6.23	120	236
Total(M ₃)	269	404

Flakiness Index (F.I) = $M_3 / M_2 \times 100$

M1 = Total Mass retained on 6.3mm Sieve and Passes 63 MM

M2 = Remaining Mass After removing those Fraction Having Mass 5% or less of Mass m 1

M3 = Combined Weight Of all Particles Passing the gauge

N.B Flakiness index Shall Be reported to the nearest whole number

Calculation : FI = $M_3 / m_2 \times 100 =$

$$FI = m_3 / m_2 \times 100$$

$$FI = 269 / 1432 \times 100$$

$$FI = 18.78$$

Prepared By

Liza Kassahun



Appendix B List of Training Participants

List of Participants in Week One:

No	Name	Employer	Job Title	Gender
1	Asnake Abebe	ERA	Engineer	Male
2	Tekle Abebe Desta	ERA	Trainer	Male
3	Ermyas Solomon	ERCC	Foreman	Male
4	H/Michael Mebrate	ERA	Foreman	Male
5	Tsegazab Tekeste	ERA	Engineer	Male
6	Adem Ebrahim	ERA	Engineer	Male
7	Damtew Feleke	ERCC	Surveyor	Male
8	Kedir Ali Mohammed	ERA	Junior Engineer	Male
9	Asmera Nassir	ERA	Junior Researcher	Male
10	Woinshet Fetene	ERA	Junior Researcher	Female
11	Sity Mensur Mudesir	ERA	Junior Researcher	Female
12	Firdawok Kebede Ayano	ERCC	Foreman	Male
13	Teshome Ayalew Tefera	ERA	Foreman	Male
14	Mohammed Sied Hassan	ERCC	Foreman	Male
15	Habtamu G/yohannes	ERA	Junior Engineer	Male
16	Megeresa Olana	ERA	Engineer	Male
17	Muluken Zergaw	ERA	Engineer	Male
18	Mussie Neway	ERA	Foreman	Male
19	Liza Kassahun	ERA	Material Inspector	Female
20	Yonas hailu	ERA	Trainer	Male
21	G/Tsadik Fsaha	ERCC	Foreman	Male
22	Kibru Yireda	ERCC	Engineer	Male
23	Amdeselassie Meles	ERCC	Foreman	Male
24	Sintayehu Kassahun	ERCC	Foreman	Male
25	Girma Kumera	ERCC	Senior Engineer	Male
26	Eshetu Yesuf	ERA	Engineer	Male
27	Abeyu Darmulo	ELDA Consulting Engineers	Engineer	Male
28	Yared Shferaw	ELDA Consulting Engineers	Engineer	Male

List of Participants in Week Two:

No	Name	Employer	Job Title	Gender
1	Bogale Taye Worku	ERCC	SURVEYOR	Male
2	Anteneh Atnafu Alemayehu	ERCC	FORMAN	Male
3	G/Tsadik Fsaha	ERCC	FORMAN	Male
4	Tesfay Meresa	ERCC	FORMAN	Male
5	Solomon Bazezew Yalew	ERCC	FORMAN	Male
6	Alemayehu Oncho	ERCC	FORMAN	Male
7	Girma Asmerom	ERCC	FORMAN	Male
8	Ermyas Solomon	ERCC	FORMAN	Male
9	Mulugeta Dejenie	ERCC	FORMAN	Male
10	Shiferaw Daba	ERCC	FORMAN	Female
11	Mohammed Sied	ERCC	FORMAN	Female
12	Kassahun Tilahun	ERCC	FORMAN	Male
13	Gosa Beyene Gemechu	ERCC	FORMAN	Male
14	Adinan Keder	ERCC	FORMAN	Male
15	Firdawok Kebede	ERCC	FORMAN	Male
16	Amdesilassie Melese	ERCC	FORMAN	Male
17	Sintayehu Kassahun	ERCC	FORMAN	Male
18	Million Tefera	ERCC	FORMAN	Male
19	Alemayehu Sisay	ERCC	FORMAN	Female
20	Dawit W/Silassie	ERA	ENGINEER	Male
21	Yared Lelisa	ERA	ENGINEER	Male
22	Zemedekun Degefaw	ERA	ENGINEER	Male
23	Yonas Darsoma	ERCC	FORMAN	Male
24	Mohammed Dari	Private	ENGINEER	Male
25	Dawit Tenkir	ERCC	ENGINEER	Male
26	Tariku Agegnehu	ERA	ENGINEER	Male
27	Anteneh Moges	ERCC	ENGINEER	Male
28	Abraham Girma	ERA	ENGINEER	Male
29	Getahun Enaro	ERA	ENGINEER	Male

Appendix C Registration Questionnaire

MODULE 1 – REGISTRATION QUESTIONNAIRE

COURSE TITLE: Training Programme for Improved Performance of Thin Bituminous Surfacing in Ethiopia (AFCAP)

1. PERSONAL DETAILS: *Please write clearly*

REGISTRATION NUMBER:	
REGISTRATION DATE:	
FULL NAME:	
JOB TITLE:	
EMPLOYER'S NAME:	

2. TYPE OF EMPLOYER:

Please indicate by ticking in the appropriate box the type of employer or employment status

Contractor	
Consultant	
Government	
Self-employed	
Unemployed	
Other, please specify	

3. LANGUAGE

Please indicate your proficiency in the following languages, where a score of 5 indicates fluency and a score of 0 indicates no knowledge:

English	0	1	2	3	4	5
Other language (please specify)						
	0	1	2	3	4	5
	0	1	2	3	4	5

4. PREVIOUS EXPERIENCE

Please indicate how many **years** of experience you have in the following areas:

How long have you been working for your current company?	0	1	2	3	4	5	6	7+
How many years of experience do you have in road works?	0	1	2	3	4	5	6	7+

Appendix D Evaluation Questionnaire

MODULE 13 – EVALUATION QUESTIONNAIRE

COURSE TITLE: Training Programme for Improved Performance of Thin Bituminous Surfacing in Ethiopia (AFCAP)

1. PERSONAL DETAILS: *Please write clearly*

REGISTRATION NUMBER:	
TODAY'S DATE:	
FULL NAME:	
JOB TITLE:	
EMPLOYER'S NAME:	

We want to ensure that the training you receive is of high quality and of relevance to your job. We would be grateful if you would complete this questionnaire as frankly and as fully as possible.

2. PRE-COURSE BRIEFING

Did you receive a pre-course briefing and joining instructions from your manager? Yes No

3. PRACTICAL RELEVANCE

Please indicate the practical relevance of the course to your job by circling the appropriate rating

Not relevant > 1 2 3 4 5 < Very relevant

4. TRAINING METHODS

In the development of your understanding and skills, please comment on the usefulness of the following training methods. Please circle the appropriate rating (1 indicating of no use ... 5 of great use, or if 'not used' during this course)

Tutor / presentation sessions	1	2	3	4	5	Not used
Group discussions	1	2	3	4	5	Not used
Case studies	1	2	3	4	5	Not used
Practical exercises	1	2	3	4	5	Not used
Videos/DVDs	1	2	3	4	5	Not used
Handouts	1	2	3	4	5	Not used

5. TRAINING SESSIONS

In the development of your understanding and skills, please comment on the quality of the training sessions by circling the appropriate rating (0 indicating not used during this course or your non-attendance of the module; 1 indicating low quality up to... 5 indicating high quality)

Module

1 Registration	0	1	2	3	4	5
2 Introduction	0	1	2	3	4	5
3 Safety & First Aid	0	1	2	3	4	5
4 Design	0	1	2	3	4	5
5 Materials	0	1	2	3	4	5
6 Equipment	0	1	2	3	4	5
7 Construction	0	1	2	3	4	5
8 Supervision & Quality Control	0	1	2	3	4	5
9 Testing & Quality Control - laboratory	0	1	2	3	4	5
10 Surface Dressing Demonstration	0	1	2	3	4	5
11 Equipment Operation & Maintenance	0	1	2	3	4	5
12 Fault Avoidance	0	1	2	3	4	5

6. FACILITIES AND ADMINISTRATION

Please indicate your satisfaction with the quality of the facilities and administration by circling the appropriate rating (1 indicating low quality 5 high quality, or the 'Not used' category).

FACILITIES:

Training rooms	1	2	3	4	5	Not used
Catering	1	2	3	4	5	Not used
Accommodation	1	2	3	4	5	Not used
Other, please specify.....	1	2	3	4	5	

ADMINISTRATION:

Joining instructions	1	2	3	4	5
Timeliness	1	2	3	4	5
Adequacy	1	2	3	4	5
Handling of any enquiries	1	2	3	4	5

7. GENERAL COMMENTS

Please add any comments which may help us improve the quality of the training experience, i.e. in terms of meeting your expectations and needs, making the programme more relevant to your job, providing a high quality of training and facilities. ***Please write clearly, thank you:***

Appendix E Worksheets

Training Programme for Improved Performance of Surface Treatments in Ethiopia

Worksheet 1 – Introduction to Surface Treatments

1 TYPES OF SURFACE TREATMENT

Draw a diagram of each of the following types of surface treatment, showing the layers that it is made from, and state the appropriate situation in which each type of surface treatment is used:

1.1 Double Surface Dressing

Appropriate situation for use:

1.2 Sandwich Surface Dressing

Appropriate situation for use:

1.3 Otta Seal

Appropriate situation for use:

1.4 Cape Seal

Appropriate situation for use:

2 QUESTIONS

- 2.1 What is the function of the bitumen in a surface dressing?**
- 2.2 What is the function of the aggregate in a surface dressing?**
- 2.3 What is the chief advantage of surface treatments?**
- 2.4 What are the economical benefits of surface treatments?**
- 2.5 What are the safety benefits of surface treatments?**
- 2.6 What are the limitations of surface treatments?**

2 EQUIPMENT

- 2.1 What are the two types of distributor?**
- 2.2 What are some differences between whirling spray jets and slotted jets?**
- 2.3 When using slotted jets, at approximately what angle to the spray bar should the jets be aligned?**
- 2.4 When using whirling jets, what is the bitumen spray protected by?**
- 2.5 What should be used to heat the bitumen? What should not be used to heat the bitumen and why not?**
- 2.6 Name a stationary test that is used to check the transverse distribution of the spray bar?**
- 2.7 What are the three main types of chipping spreader and which is the most effective?**
- 2.8 What are the two types of roller and which one is the best? Why is it the best?**
- 2.9 Name two pieces of equipment that should be used to clean the road surface before applying a surface dressing?**

Training Programme for Improved Performance of Surface Treatments in Ethiopia Worksheet 3 – Construction of Surface Treatments

1 PREPARATION OF EXISTING ROAD SURFACE

- 1.1 With normal traffic levels, what should be the minimum CBR of the material in the existing road base? What should be the maximum Plasticity Index (PI) of the road base material?

- 1.2 Name some problems that can exist in a road base that must be corrected before a surface treatment is applied?

- 1.3 What must be cleaned from the road surface before applying a surface dressing?

2 APPLYING A PRIME COAT

- 2.1 What are the purposes of a prime coat?

- 2.2 What should be applied to the surface if too much prime is applied?

3 CONSTRUCTION OF A DOUBLE SURFACE DRESSING

- 3.1 What are the eight stages of constructing a double surface dressing?

- 3.2 What is the minimum and maximum spraying temperature for MC 30?**
- 3.3 What is the minimum and maximum spraying temperature for MC 3000?**
- 3.4 What is the minimum and maximum spraying temperature for 80/100?**
- 3.5 What is the maximum spraying temperature for 60% emulsion?**
- 3.6 In a double surface dressing, how long should traffic ideally be allowed onto the first seal before the second seal is applied?**
- 3.7 What are the materials used in a slurry seal and in what quantities?**
- 3.8 What types of bitumen are used in slurry seal?**
- 3.9 Name six basic stages in the construction of an Otta seal?**