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PREPARATION OF RURAL ROADS TRAINING MODULES
(ESCAP)

Report on a Visit to Thailand

By
Dr. J.D.G.F. Howe
I.T. Transport Ltd.

23rd February - 13th March 1987

on behalf of
International Development Research Centre



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March 1987 P 7
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- ANNEX 4: IRF Video Training Aids Series on Road Maintenance.
- ANNEX 5: Contents of ILO Guide to the Training of Supervisors for Labour-Based Road Construction and Maintenance.
- ANNEX 6: Contents of Phase 1 Training Modules.
- ANNEX 7: Tasks Involved in Drafting the Technical Content of Phase 1 Modules.

ABBREVIATIONS

CE	Communications Expert, Dr. R. Lewis.
CRRI	Central Road Research Institute, India.
DPW	Department of Public Works, Thailand.
ECA	United Nations Economic Commission for Africa.
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific.
ILO	International Labour Organisation.
IRF	International Road Federation.
MPWH	Ministry of Public Works and Highways, Philippines.
TC	Technical Consultant, Dr. J.D.G.F. Howe.
TRRL	Transport and Road Research Laboratory, UK.

1. EXECUTIVE SUMMARY

1. This report describes the work of the technical consultant on the Preparation of Rural Roads Training Modules in Bangkok from 23rd February to 13th March 1987 with the Transport, Communications and Tourism Division of ESCAP on behalf of the International Development Research Centre of Canada. The substance of the assignment was to develop the module concept by participation in an expert group meeting, and subsequent work with the communications expert and ESCAP staff.
2. The expert group meeting discussions centred on the report of Mr. T.K. Natarajan - Central Road Research Institute (CRRI), India - on the training needs of staff engaged in rural road construction and maintenance in member countries of the ESCAP region (Natarajan Report), and a collection of video and audio-slide training materials.
3. There was a consensus of opinion that the proposed training material ought to emphasise a labour-based equipment supported approach to rural road construction and maintenance, and that the content of the modules, as proposed in the Natarajan report, should to be altered to give more emphasis to road maintenance.
4. Because of the limited funds available for the production of the training materials it is proposed that they be produced in two phases. Phase 1 will cover the production of the sixteen most generally useful training modules, and an introductory module. Four of the sixteen modules will deal solely with road maintenance. (A detailed outline of the proposed contents of all the Phase 1 modules is given in this report). Phase 2 covers the production of six modules covering more specialised aspects of road construction technology in the ESCAP region. The intention is that, if necessary, the Phase 1 modules will be used to publicise and seek funding for those in Phase 2.
5. Each module will comprise a trainee's guide, giving all the information essential to the conduct of the course; a trainers guide outlining the procedures for conducting the training; and audio-visual material as appropriate. The emphasis of all the material will be on "basic concepts and fundamental tasks" (ie. that package of knowledge and skills that will enable trainees to execute road construction and maintenance work more efficiently after the course than they were able to before training). The training modules will be of different lengths, but the overall design will be structured so that, on average, one module covers one days instruction.
6. A review was conducted of source material available for the production of the training modules including the ESCAP manuals on road construction and maintenance. As part of this review two trial trainee guide contents were assembled. This exercise demonstrated that existing material will need to be:
 - supplemented so as to include recent technological developments;
 - assembled in a format suitable for the production of trainee and trainer requirements, and the scripts for the

7. The consultants jointly prepared a fourteen step implementation programme for the production of the training modules which should lead to completion of the Phase 1 modules within one year of commencing work. It is intended that production of the visual material will be in up to three member countries of ESCAP and, if practicable, in collaboration with on-going ILO labour-based road construction and maintenance projects.
8. It is sensible for ESCAP to negotiate a working agreement with ILO for the production of visual material as soon as possible because of the latter's experience with labour-based projects and the direct access it has to on-going road construction and maintenance projects in a number of countries.
9. Production of the training modules will require the services of a communications expert and a technical consultant. An outline of their terms of reference is given in the implementation programme. The total consultancy input is estimated at six man months.
10. The cost of the Phase 1 implementation programme is tentatively estimated at \$95,000. It is particularly difficult to estimate visual material costs without production scripts, and because there is little detailed information available on the breakdown of video shooting costs in the ESCAP region. For this reason it is recommended that:
 - i) a contingency percentage be added to the above cost estimate;
 - ii) ESCAP seek details of video production costs from relevant member countries; and
 - iii) the estimates are revised on the basis of ii) and production script guidelines.

2. INTRODUCTION

1. By contract (Centre File: 3-P-85-0032-01) dated 5th February 1987 I.T. Transport Ltd. was engaged by the International Development Research Centre (Canada) to supply technical consultancy services to the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). Dr. J.D.G.F. Howe of I.T. Transport was retained for a period of 21 days.

2.1 Terms of Reference

2. The Terms of Reference for the assignment were as follows:

- a) to travel to Bangkok to participate in the February 25th-27th meeting being convened by the Economic and Social Commission for Asia and the Pacific (ESCAP) on the Preparation of Rural Roads Training Modules;
- b) to meet and work with the Communications Expert (CE), Dr. R. Lewis, and ESCAP staff in the development of the project;
- c) to work with the ESCAP staff to identify the target groups to be reached with the proposed training course;
- d) to propose~~d~~ appropriate training methodologies and to prepare an outline and identify the types of training materials required;
- e) to assist ESCAP in reformulating the project budget if required; and
- f) to submit a detailed and satisfactory report of the work accomplished to the Director of the Information Sciences Division of the Centre by 10th April, 1987.

2.2 Structure of the Assignment

3. The assignment essentially comprised two elements:

- i) participation in the meeting on the Preparation of Rural Roads Training Modules from 25th-27th February;
- ii) subsequent work with the CE on the development of the module concept from 28th February to 13th March.

3. MEETING ON THE PREPARATION OF RURAL ROAD TRAINING MODULES

4. The programme for the meeting and list of participants are given in Annex 1. Discussions at the meeting were based on two main sources of information:

- i) the report on the training needs of staff engaged in rural road construction and maintenance in member countries of the ESCAP region, prepared by Mr. T.K. Natarajan (Deputy Director, Central Road Research Institute (CRRI), New Delhi). This will be referred to as the Natarajan Report and is attached as Annex 2.
- ii) a collection of video and audio-slide training material from the International Road Federation (IRF); International Labour Organisation (ILO); Transport and Road Research Laboratory (TRRL), UK; Ministry of Public Works and Highways (MPWH), Philippines; the CRRI; and the Department of Public Works (DPW), Thailand.

3.1 Natarajan Report

5. In summary the conclusions from the Natarajan Report on training needs in the ESCAP region were as follows:

- i) there is a need to augment existing institutional arrangements for the training of local level officials, since in most countries they either do not receive organised training, or the material is not well adapted to the requirements of rural roads;
- ii) the use of audio-visual training material is uncommon in some countries, notably India, and in others that available is considered to be inappropriate since it is oriented towards equipment-intensive rather than labour-based construction and maintenance technologies;
- iii) most senior and middle level personnel have the benefit of a systematic engineering education, but more junior staff invariably receive little training other than accumulated experience. It is this group which is considered most in need of training;
- iv) the focus of local level training should be on junior level technical staff directly involved in rural road construction and maintenance. This category will include the foreman, overseer, supervisor, junior engineer, site engineer, technician, "civil engineer", "associate civil engineer" as variously designated in different countries;
- v) the technical content of any proposed training material will need to be fairly broadly structured to cater for the wide variations in pavement types, materials, climate and terrain;
- vi) the technical content of each of the proposed modules needs to be carefully thought through before the mode of presentation is decided. Video presentations may not be appropriate in all modules. In others lecture notes and slide projection may be more appropriate;

- viii) the technical content of a training programme comprising fifteen modules is outlined. This programme is intended to be conducted over a period of two weeks;
- ix) the content of each module should reflect both labour-based and equipment-intensive approaches to road construction and maintenance, as appropriate;
- x) it might be possible to include in the proposed modules material from the stock of slides available with the Bina Marga Training Centre, Indonesia and with the Manpower Development Services of the MPWH, Philippines. Other material should also be available from the CRRRI and ILO. Some video material has been compiled by the PWD, Thailand and this might also be incorporated in the proposed modules;
- xi) it was not considered necessary to produce new notes in support of the proposal video modules, since the ESCAP manuals on road construction and maintenance¹ could serve as background material
- x) consideration might be given to reducing the proposed regional workshops from two to one so as to release more funds for the preparation of good quality training modules.

3.1.1 Participant Reactions to the Natarajan Report

6. Mr. Natartajan's conclusions were broadly accepted by the participants in relation to the need for and forms of training, and the greater use of audio-visual material. Some reservations were, however, expressed about the technical content of the proposed modules. There was a consensus of opinion that the modules ought to emphasize a more labour-based approach to road construction and maintenance as reflected in the ILO's "Guide to the Training of Supervisor's for Labour-Based Road Construction and Maintenance". Also that the content of the modules should be altered so as to give a better balance between construction and maintenance. To facilitate production in a local language it was considered essential to have a master copy of each module prepared in English. The ILO representative also considered it unlikely that a suitable training course could be completed in a period as short as two weeks. Based on their experience of implementing programmes of labour-based road construction and maintenance a period of about six-weeks is considered necessary.

3.2 Video and Audio-Slide Training Material

7. The complete list of audio-visual material presented at the meeting is given in Annex 3. A detailed analysis of this is to be found in the report of the CE. The following are the views of the TC only.

3.2.1 IRE Video Training Aids Series on Road Maintenance

8. The complete list of IRF Video Training Aids is given in Annex 4. After viewing the demonstration tape previewing the whole series the participants viewed the following modules:

- 1. Common Maintenance Problems and Causes.
- 9. Patching Unpaved Roads.
- 15. Clearing Lined Ditches, Culverts and Catch Basins.

¹ ESCAP Manual on rural road construction. Bangkok, 1981.

ESCAP Manual on rural road maintenance. Bangkok. 1981

The individual modules emphasize "fundamental tasks and basic concepts". That is, they follow an essential steps approach with emphasis on those tasks which are fundamental to the success of, and the basic concepts underlying, the activity that is being considered. In each case the module is split into three, unequal length, sections:

1. A brief description and illustration is given of each of the basic steps comprising the activity.
2. Each step is then described and illustrated in detail.
3. A brief - descriptive and illustrative - re-capitulation of each of the basic steps terminates the module.

This follows a well established principle of teaching often associated with the Army:

- tell them what you are going to tell them;
- tell them;
- tell them what you have told them.

9. The general standard of production of the IRF video's appears to be very high. The three most apparent defects are that:

- i) the approach is essentially equipment-intensive and appropriate to developed countries or organisations responsible for major highways;
- ii) the modules do not appear to be accompanied by any written material for trainers or trainees;
- iii) the cost of the modules, at approximately \$600 each.

3.2.2 ILO Video Training Films on Labour-Based Road Construction and Maintenance

10. It was explained that the ILO has a limited amount of funds (approximately \$30,000) for the production of video based material to complement its existing training course based on the "Guide to the Training of Supervisors for Labour-Based Road Construction and Maintenance"¹. The donor source of ILO's funds requires that they be spent in support of various on-going labour-based road construction and maintenance programmes in Africa. However, since many of the individual road construction and maintenance activities in Africa and Asia are very similar, the ILO is of the opinion that with careful design and production, video material could be both produced and used in either continent. It is important for the ILO to do this since it is providing technical support

1 This Guide has been produced for use in the general and technical training of supervisors for road construction and maintenance programmes. It is basically in two parts, an instructors manual and a trainees manual. The former contains information and advice for instructors on how to plan, design and implement a training course. The latter provides the detailed training material for the trainees. In its present form the trainees manual is incomplete in that it is not country specific. Thus, such aspects as project organisation and administration, programme objectives and design standards will vary from country to country. The instructor, therefore, uses the general

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- v) the technical content of any proposed training material will need to be fairly broadly structured to cater for the wide variations in pavement types, materials, climate and terrain;
- vi) the technical content of each of the proposed modules needs to be carefully thought through before the mode of presentation is decided. Video presentations may not be appropriate in all modules. In others lecture notes and slide projection may be more appropriate;
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to labour-based road construction and maintenance programmes in both Asia¹ and Africa. For this reason the ILO is keen to collaborate with ESCAP in the production of suitable training material.

11. Two video films were shown by the ILO. The first film was essentially promotional in orientation, and designed to make the "case" for a more labour-based approach to rural road construction and maintenance in Thailand. As such it is aimed at planners and decision makers at all levels as much as the people who will actually organize and do the work. The film was considered to be perfectly adequate for its intended purpose.

12. The second film was a (pilot) studio production concerned with planning. The consensus of opinion appeared to be that the subject did not lend itself well to the video format alone. The basic concepts and fundamental tasks of planning are essentially static, rather than dynamic, and slides, overhead projections, or lecture notes and exercises were considered to be a more appropriate method of teaching. It was suggested that the whole training concept behind this film ought to be re-examined, so as to introduce an IRF type learning structure, and the material broken down into shorter-length component parts.

3.2.3 TRRL Video on Road Maintenance

13. TRRL made available a video film on road maintenance which was originally produced by the Road Directorate of Guyana. The film deliberately uses humour to illustrate the "wrong" and "right" way of executing some basic road maintenance tasks. Such a film might serve to "lighten" the mood of an intensive training course. However, deliberately emphasizing "wrong" and "right" behaviour, as a regular part of training material, was not considered sensible, since research suggests that it tends to confuse trainees.

3.2.4 CRRI Video Films on Road Construction

14. These films were produced experimentally by the CRRI specifically for the ESCAP meeting. They covered the construction of Water Bound Macadam sub-bases and bases and lime-stabilized sub-bases. In general it was considered that the overall approach to both films gave too much emphasis to traditional construction practices which emphasise quality control tests. On most rural road sites these would be very difficult. The coverage of the technical material was also more detailed than, for example, in the IRF videos, ie. they did not really distinguish between information that it was nice for the trainee to know and that which he needed to know to carry out the task correctly. The films did not appear to give sufficient attention to safety aspects and in fact contained examples of unsafe behaviour. However, both films do contain the basic material necessary for a video training module on these subjects given corresponding trainee and trainer guides, and production script guidelines.

1 The ILO is actively involved in labour-based programmes in India, Laos, Nepal, Philippines, Thailand and Western Samoa. Only two of the programmes do not have a significant "roads" content, nevertheless they could all use some of the module elements.

3.2.5 MPWH (Philippines) Training Material

15. The MPWH is engaged in the production of six audio-visual modules as part of a "Training Series on Labour-Based Road Construction and Maintenance". They are as follows:

MODULE	TITLE
LBRCM - 1	Overview
LBRCM - 2	Pre-Construction Activities
LBRCM - 3	The Activity Resource Plan
LBRCM - 4	Hand Tools and Other Implements
LBRCM - 5	Basic Construction Activities
LBRCM - 6	Basic Maintenance Activities

16. The modules are complemented by a (trainers) Training Manual¹. The Training Manual outlines the methodology to be used by trainers when presenting a two week course for supervisors involved with using labour-based techniques for rural road construction and maintenance. It is envisaged that this course be run in close proximity to an on-going rural road construction project for practical and on-the-job training purposes and where classroom and accommodation facilities are available for the course participants. The course consists of 60% classroom, or theoretical, training and 40% practical and on-the-job training. It includes the following subject matter; an introduction to the use of labour-based technology in general, surveying and setting out, site organisation, planning and programming, monitoring and reporting, guidelines for travelling operations, hand tools and equipment, and finally, maintenance using labour-based methods.

17. To date only the first two modules have been produced, and they have not been subject to final editing. Both are based on the use of slides with a synchronised audio commentary. The meeting was shown modules 1 and 2. Both seemed to have been prepared proficiently, but judgement on their usefulness was impaired by malfunctioning of the equipment which resulted in the slides and commentary not being fully synchronised. Also, in some cases the slides were not really complementary to the script.

18. The medium is potentially a relatively cheap and flexible one since it is comparatively easy to change material as the technology of construction and maintenance progresses. However, there are still serious reservations to be overcome concerning the reliability of the audio-slide technology itself.

3.2.6 ILO/PWD (Thailand) Video Training Film

19. This film was produced as part of the Lamphun road project in northern Thailand. It appeared to be serving both a promotional and training purpose. Whilst there were many good aspects to the film the general consensus was that it would be much improved by better design and judicious editing. This was accepted by the authors who said it would be edited to use as introductory material for training courses rather than as training material per se.

¹ MINISTRY OF PUBLIC WORKS AND HIGHWAYS. Application of Labour-Based Methods in Road Construction and Maintenance: A Supervisor Training Manual. Manila, September 1986.

3.3 Discussions on the Module Concept

3.3.1 Trainees

20. It was accepted that potential trainees would have different levels of education in different countries of the region, and therefore that the definition of them given in the Natarajan Report (para 5 (iv) this report) was the clearest that was practicable. The most important qualification of the trainees was that they were actually involved in, or about to be involved in, the supervision of rural road projects. It was also considered important to acknowledge that many trainees might require re-orientation towards labour-based techniques to overcome any prejudices resulting from their education or previous equipment intensive experience.

3.3.2 Trainers

21. The discussion centred on whether the proposed video films, under the ESCAP initiative, could be produced as stand-alone teaching aids or whether trainers should be presumed and provision made for complementary guidance to them in the form of other training materials (eg. notes, slides, overhead projector transparencies). The consensus of opinion was that it would be a mistake to produce just video films alone. For efficient and effective teaching they had to be viewed as a component part of a well designed package comprising advice to trainers, material for trainees and other visual learning aids. However, given the many country-level variations in terrain, construction technology and organisation it would equally be a mistake to try to produce too comprehensive a teaching package. ESCAP should concentrate on the general guidelines and the most common activities, in fact IRF's "basic concepts and fundamental tasks" approach.

3.3.3 Scope of the Training Material

22. The discussions on the scope of the training materials revolved around three issues:

- standard of the rural roads that would be constructed and maintained;
- level of technology that would be used; and
- balance of the modules between construction and maintenance.

It was agreed that the training materials should be focused on relatively low traffic volume rural roads (50 or less vehicles per day) constructed of earth with at most a gravel or comparably hard surfacing. Such a focus would eschew inclusion of techniques for bituminous surfaced road construction. However, techniques for the maintenance of bituminous surfaced roads should be included in the modules on maintenance. For rural roads of the type defined it was agreed that labour-based construction techniques were most appropriate although these should be supported by equipment where this was technically and economically necessary. The consensus of opinion was that the balance of the modules defined in the Natarajan Report ought to be altered to increase those concerned with maintenance.

23. Because of limitations of the funds available for the production of the training materials it was proposed that the work be tackled in phases. The first phase should cover those modules that are of most general interest. The intention is that, if necessary, they be used to publicise and seek funding for the production of the second phase modules

covering more regionally specialised aspects of construction and maintenance. It was agreed that in the first phase work should concentrate on the production of the following modules:

Phase 1: Modules

1. Introduction to the Training Modules on Rural Road Construction and Maintenance.
2. Planning.
3. Reporting and Control.
4. Work Organisation.
5. Tools and Equipment.
6. Concrete Technology.
7. Survey and Setting Out.
8. Clearing.
9. Earthwork.
10. Compaction.
11. Gravelling.
12. Drainage.
13. Construction of Small Drainage Structures.
14. Maintenance Systems, Organisation and Management.
15. Maintenance of Unpaved Roads.
16. Maintenance of Paved Roads.
17. Maintenance of Drainage Structures.

24. In the second phase modules will be prepared on:

Phase 2: Modules

18. Soil Testing.
19. Water Bound Macadam Surfacing.
20. Lime-Stabilised Bases and Sub-Bases.
21. Road Construction with Coral.
22. Road Construction with Bricks.
23. Road Construction with Concrete Blocks.

These modules are important so as to allow for different levels of technology within the ESCAP region, and for regional variations in the materials and techniques used for rural road construction.

3.4 Suggested Work Programme of Consultants

25. After discussions with the participants it was agreed that in the two weeks after the meeting the consultants should concentrate on the following:

- i) development of more comprehensive module descriptions integrating the contents of the Natarajan and ILO outlines, simplifying some of proposed aspects of the modules described in the Natarajan Report, and emphasising a more intermediate - labour-based, equipment supported - approach to rural road construction and maintenance;
- ii) definition of guidelines for the design and production of the modules to maximise the efficiency of teaching;

iii) production of draft outlines of example modules¹ in the following preferred order:

- 2. Planning
- 10. Compaction
- 15. Maintenance techniques
- 8. Clearing
- 12. Drainage

iv) description of the most practicable design and production process for all the training modules, the contributions expected from the various regional and national organisations, and definition of a revised design and production budget including phasing.

¹ This group was chosen to reflect the range of module types in terms of the different teaching methods that might be employed - instruction notes, exercises, slides, video films, etc. It was understood that the consultants would complete as much work on these outlines as time and the availability of necessary materials permitted.

4. WORK PROGRAMME OF THE CONSULTANTS

4.1 Further Work on the Module Concept

26. Prior to implementing the suggested work programme the consultants gave further consideration to the module concept so as to:

- i) define an efficient and effective process of module design and production; and
- ii) consider the utility of various possible source material for the technical contents of the modules.

The definition of (i) is discussed in detail in the report of the CE. In essence it comprises the following steps:

1. Analyse Training Situation.
2. Specify Instruction Context.
3. Define Training Objectives.
4. Design Tests of Objectives.
5. Design Training Modules.
6. Produce and Release Modules.

The consideration of 26 (ii) is essentially concerned with step 2.

4.2 Possible Source Material for the Technical Contents of the Modules

27. The concern in this section of the report is to consider the suitability of possible source material for the technical contents of the modules. The material is required to be:

- comprehensive in its coverage of the intended modules;
- up-to-date so as to include relevant technological developments; and
- in a format suitable for the production of trainer and trainee requirements, and the scripts for the production of suitable visual materials.

None of the obvious material sources meet these requirements in full, but some come closer than others.

4.2.1 ESCAP Manuals on Road Construction and Maintenance

28. These were published in 1981 so probably reflect technological developments up to one or two years earlier. They have an evident bias towards the road construction and maintenance technologies of the Indian sub-continent. This is helpful in some respects - since it reflects the considerable diversity of techniques associated with that sub-region - but not others eg. they do not reflect modern attempts to improve the management and quality of labour-based works. Both manuals are concerned mainly with techniques and say little about planning, organisation and management. They will be very useful as reference sources, but the format of the information is not directly adaptable to trainer, trainee or visual material production script requirements.

4.2.2 ILO Guide to the Training of Supervisors for Labour-Based Road Construction and Maintenance

29. This was designed as a general guide that would need to be supplemented, by the trainer, with country specific information. It was

specifically aimed at supervisors which is broadly the target of the modules under the ESCAP initiative. The material is in the form of separate, but complementary, trainer and trainee modules. In comparison with the modules proposed under the ESCAP initiative the main omissions from the contents of the ILO guide (Annex 5) is in respect to maintenance systems, organisation and management since much of the experimentation with these aspects has been since the guide was published in 1982. There have also been technological developments since 1982, especially with construction and maintenance equipment, that have necessarily been excluded from the guide. Perhaps the biggest difficulty with the ILO guide as it stands is the amount of supplementary information the course instructor is expected to provide. Such an approach is necessary to allow the material to be adapted to local conditions. However, it does presume the existence of a considerable amount of experience which may not be the case in countries and organisations new to the concept of labour-based equipment-supported road construction and maintenance. It is suggested therefore that some notional information ought always to be provided as part of the training material to be produced under the ESCAP initiative. This information could always be replaced by local data if that is known and available to the trainer. A further problem is that the ILO course is designed to cover a six-week period of instruction: double that proposed for the ESCAP modules. This implies that the ILO material must be reduced by half either by simplification, or by reducing the component elements that make up each module (Annex 5).

30. The ILO guide is an excellent basis for the production of some of the proposed training modules and has already been subjected to considerable practical use. The sections on maintenance and equipment will need to be both expanded and simplified, and trainer and trainee written material may also need to be re-formatted to reflect a stronger "basic concepts and fundamental tasks" approach that is intended for the proposed modules. More fundamentally the whole manuscript should be reviewed to:

- i) check its technical content against more recently available material, especially that from World Bank¹, CRRI and TRRL sources, and the field experience of the ILO itself.
- ii) evaluate its efficiency and effectiveness as a training package; and
- iii) draft scripts for the production of suitable visual material.

4.2.3 MPWH (Philippines) Supervisors Training Manual²

31. This has been drafted with ILO assistance and clearly reflects the ILO Guide. It appears to be a much more simplified version since the intended course length is only fourteen days, comprising the following modules:

1. Introduction to the Use of Labour-Based Methods.
2. Survey and Setting-Out Techniques.
3. Site Organisation and Labour Management.
4. Planning/Programming/Monitoring.

1 WORLD BANK. Labour-based construction programmes: a practical guide for planning and management. Washington, 1983.

2 MINISTRY OF PUBLIC WORKS AND HIGHWAYS. Application of labour-based methods in road construction and maintenance: a supervisor training manual. Manila, 1986.

5. Hand Tools and Equipment.
6. Guidelines to Graveling Operation.
7. Maintenance using Labour-Based Methods.

Only a detailed comparison with the ILO Guide can show if there are aspects of the MPWH material that ought to be included in the proposed training modules.

4.2.4 United Nations Economic Commission for Africa (ECA) Road Maintenance Handbook

32. The handbook was published in 1982 as a guide to road foreman. It consists of the following three volumes:

- | | |
|-----------|---|
| Volume 1: | Maintenance of roadside areas, drainage structures and traffic control devices. |
| Volume 2: | Maintenance of unpaved roads. |
| Volume 3: | Maintenance of paved roads. |

It was conceived as a ready reference book. It was produced with a concise factual text and is well illustrated with numerous photographs, drawings and sketches. The handbook complements the ESCAP manual on road maintenance, and together they should provide almost all the material required for the proposed modules.

4.2.5 World Bank Manual¹

33. The manual is based on research and field applications of labour-based construction methods undertaken since 1971 as part of the Study of Labour and Capital Substitution in Civil Construction, conducted by the Transportation and Water Department of the World Bank. It represents the state-of-the-art up to about 1981. The format is that of a comprehensive report, which contains much useful reference data, but it is written for senior level engineers and planners rather than 'local level' officials and engineers. It is particularly useful as a source of general procedures and productivity rates where country specific data is lacking.

34. In addition to the material sources described above it is important that organisations such as ILO, TRRL and CRRI are canvassed about the most recent developments in labour-based road construction and maintenance. This is particularly the case for technological and organisational developments that have taken place since 1981-82, the date of publication of most of the comprehensive material sources.

4.3 Module Descriptions

35. Work on detailed module descriptions concentrated on those to be included in Phase 1 of the design and production programme as defined in Section 4. A fuller description of the contents of each of the Phase 1 modules is given in Annex 6.

4.4 Guidelines for the Design and Production of the Modules

36. These are discussed in detail in the report of the communications expert and will not be commented on further here.

¹ WORLD BANK Manual Op. cit.

4.5 Work on the Draft Outlines of Example Modules

37. Time and the lack of all necessary background material only permitted limited work on the Planning and Compaction module outlines. In each case the same procedure was used. First existing source material, as discussed in section 4.2 of this report, was assembled in a photocopied form so as to represent a 'coarse' block of trainee information. This was then sorted into a logical content order and any obvious omissions noted. The information was then used to define exactly what the trainee was expected to be able to accomplish on completion of the specific training module. For example, 'to be able to evaluate the appropriateness of a camp layout against established standards', or 'to be able to describe the role of moisture in compaction and consolidation'. These accomplishments were then ordered so as to define the major procedures, or objectives, the trainees would be expected to follow having completed the training module. This approach led to a refinement of the original 'coarse' block of information by distinguishing between what a trainee 'needs to know' and that which it is merely 'nice if he knows'. The next stage in the process, which time did not permit, would be to further refine the information by checking to determine:

- i) if the trainee has in fact been supplied with all the data necessary to accomplish the expected tasks; and
- ii) what pre-requisite learning is implied on behalf of the trainee.

Subsequently the same approach would be applied to the more minor procedures, or sub-objectives, comprising each major procedure. It is in this way that each training module will be structured to emphasise only basic concepts and fundamental tasks.

5. IMPLEMENTATION PROGRAMME FOR PRODUCTION OF THE TRAINING MODULES

5.1 Activities

38. The CE has described the instructional design model for producing the rural road training modules in his report. Some aspects of this process were addressed at the meeting on the 25th-27th February 1987. The proposed implementation programme for production of the training modules comprises the following activities:

1. Further analysis of the design situation by questionnaire survey (CE).
2. Drafting of objectives and technical content of the modules, and specification of pre-requisite learning (TC).
3. Review of technical content by ESCAP.
4. Preparation of tests of technical content, selection of instructional strategy, selection of media and specification of visual material required (CE).
5. Consultation between CE and TC on integration of trainees and trainers guides, and production script guidelines.
6. Drafting of trainees and trainers guides (TC).
7. Drafting of production script guidelines (CE).
8. Review of trainees and trainers guide, and shooting script guidelines (CE/ESCAP).
9. Assignment of visual material production guidelines to member countries for detailing of shooting scripts (ESCAP).
10. Production of shooting scripts by member countries in consultation with CE.
11. Printing of trainees and trainer's guides and reproduction of visual material (ESCAP).
12. Meeting to review trainees and trainers guides, and draft visual materials by expert group from member countries and organisations associated with the project such as CRRI, ILO and TRRL.
13. Editing of trainees and trainers guides, and draft videos in the light of expert group comments, and reproduction of the videos.
14. Regional meeting of trainers.

Step 1: Additional information on the trainees, the trainers and the usage situation should be obtained using a questionnaire designed by the CE and administered by ESCAP staff. The results will be summarised and used in the design process by the CE.

Step 2: The tasks that the TC will have to undertake in executing this step are described in detail in Annex 7. These could be used as

- Step 3: ESCAP should require that the TC produces the drafts of the technical content in batches. This will enable a continual review process by the CE and ESCAP and speed-up the overall production.
- Step 4: The CE will design tests based on the objectives and content from the TC. The CE will design an instructional strategy describing what will be taught, how it will be taught, in which order and using which media. The result of this process will be an overall plan for each module, providing instructions for the preparation of the trainer's and trainees' guides. The CE will prepare specific guidelines for the visual materials required.
- Step 5: It is considered essential that the CE and TC should have a joint consultation on the trainees and trainers guides, and production of the visual material script guidelines. An allowance has been made in the associate resource estimates for a nominal travel cost and subsistence allowance for one consultant for one week.
- Step 6: The main drafting of the trainee and trainer guides should be done in one period. However, arrangements could be made to release guides to ESCAP in batches so as to speed-up the overall production processes.
- Step 7: As step 6.
- Step 8: It is preferable that the CE and ESCAP jointly carry out a short review of the final trainees and trainers guides, and the shooting script guidelines.
- Step 9: ESCAP should initiate negotiations on the assignment of visual material production guidelines to member countries as soon as possible. Actual assignment will not be possible until the draft guides and visual material production guidelines are available.
- Step 10: The time allowed for this activity assumes that production would take place in three member countries and by the ILO. For estimation purposes it is assumed that each individual script requires one month's work.
- Step 11: The cost of printing trainees and trainers guides, and the reproduction of visual material have not been included in the estimate of resources, since this requires a decision concerning the scale and conditions of distribution by ESCAP. However, in addition to the printing and reproduction costs it is important to allow for the actual costs of distribution.
- Step 12: It is important that the draft trainee and trainer guides, and draft visual materials are reviewed - by an expert group drawn from ESCAP member countries and organisations associated with the project - prior to their reproduction in quantity and distribution. It would be preferable if the trainee and trainer guides could be distributed to the delegates in advance of the review meeting.
- Step 13: Both the guides and visual materials are likely to require editing as a result of the review meeting. This is clearly best

Step 14: This marks the outcome of the whole project. It would be helpful if both the CE and TC could attend the meeting so as to evaluate reactions to the training modules.

5.2 Timetable of Activities

39. Figure 5.1 presents an estimated timetable of activities. Gaps have been left in some of the activities to allow time for postal communications between the various individuals and organisations.

5.3 Resources

40. Consultancy resources are indispensable to the production of the proposed training modules if they are to be efficient as teaching materials and to reflect the latest technical developments in the application of labour-based equipment-supported methods to road construction and maintenance. The services of both a communications expert and a technical consultant will be required.

5.3.1 Communications Expert (CE)

41. The role of the communications expert is to design instruction which will achieve the stated instructional objectives. At the outset, the CE will work closely with the technical consultant to ensure that the information on the units arrives in a form which will facilitate the design of instruction. Once the draft content arrives, the CE will design the actual instruction. The design process will include the preparation of tests of the content, and selection of the instructional strategy and the selection of the media. In addition, the CE will develop an overall plan for each module. This plan will describe how the three elements (trainer's guide, trainees' guide and visual material) are to be integrated. The CE will also prepare script guidelines for producers. The CE will then advise producers on the preparation of the shooting script. During production, the CE may be available to assist the producers.

42. The CE will require a thorough knowledge of the process of instructional design, production and evaluation. He/she also should have some experience in developing countries and should be able to work with content experts to develop instruction. He/she should be able to work with the technical consultant in his/her home location and to travel to the production sites to consult with the producing agencies.

43. It is estimated that the CE's services will be required for three months. However, the work to be undertaken will have to take place over a span of about ten months. A suitable consultant is likely to cost about \$6,000-7,000 per month. This amount includes the costs of photocopying, communications and postage.

5.3.2 Technical Consultant (TC)

44. The TC's main role, as detailed in Annex 7, is to draft the trainee and trainer guides. This will require an intimate knowledge of both the relevant literature on, and practice of, local level road construction and maintenance in the ESCAP region. It will also require considerable experience of modern efforts to introduce and improve efficiency of labour-based, equipment-supported rural road construction and maintenance world-wide. The consultant should be required to demonstrate familiarity with recent work by the ILO, TRRL and World Bank in this field. He must

45. Efforts to improve the efficiency of labour-based road construction and maintenance methods are comparatively recent, as a result there are relatively few consultants with the necessary experience for such an assignment. It is suggested that the ILO or World Bank be contacted to supply a list of suitable consultants.

46. It is estimated that the TC's services will be required for a period of 3 man months in total for the tasks defined in Annex 7. A suitably qualified consultant is likely to cost about \$6,000-\$7,000 per month inclusive of an allowance for the significant amount of communications, liaison, photocopying and typing expenses.

5.3.3 Visual Material Production Costs

47. The major resources requirement is funds to cover the visual material production costs. At this stage without draft guides or script guidelines it is only possible to give an order of magnitude estimate of costs. Information on both the time and cost of video production reported at the meeting on 25th-27th February 1987 was too imprecise to form a satisfactory basis for estimation¹. Because of the imprecision of this data it was decided to use a figure of \$5,000 per module on the assumption of an average of 30 minutes of finished film per unit. The cost of each module can be reduced by the use of existing visual materials and a simplification of the production process. Also, a preliminary assessment of the phase 1 modules suggests that not all will require complex video materials. Production cost estimates have been based on ten video units.

5.3.4 Summary of Implementation Costs

48. Production of ten video units @ \$5,000 each	50,000
Consultation travel costs and per diem for one week	1,500
Travel and per diem costs for CE support to production units:	
- travel \$1,800	
- per diem \$90 x 30 days	4,500
Hire of Communications Expert (3 man months)	19,500
Hire of Technical Consultant (3 man months)	19,500
	<u>\$95,000</u>

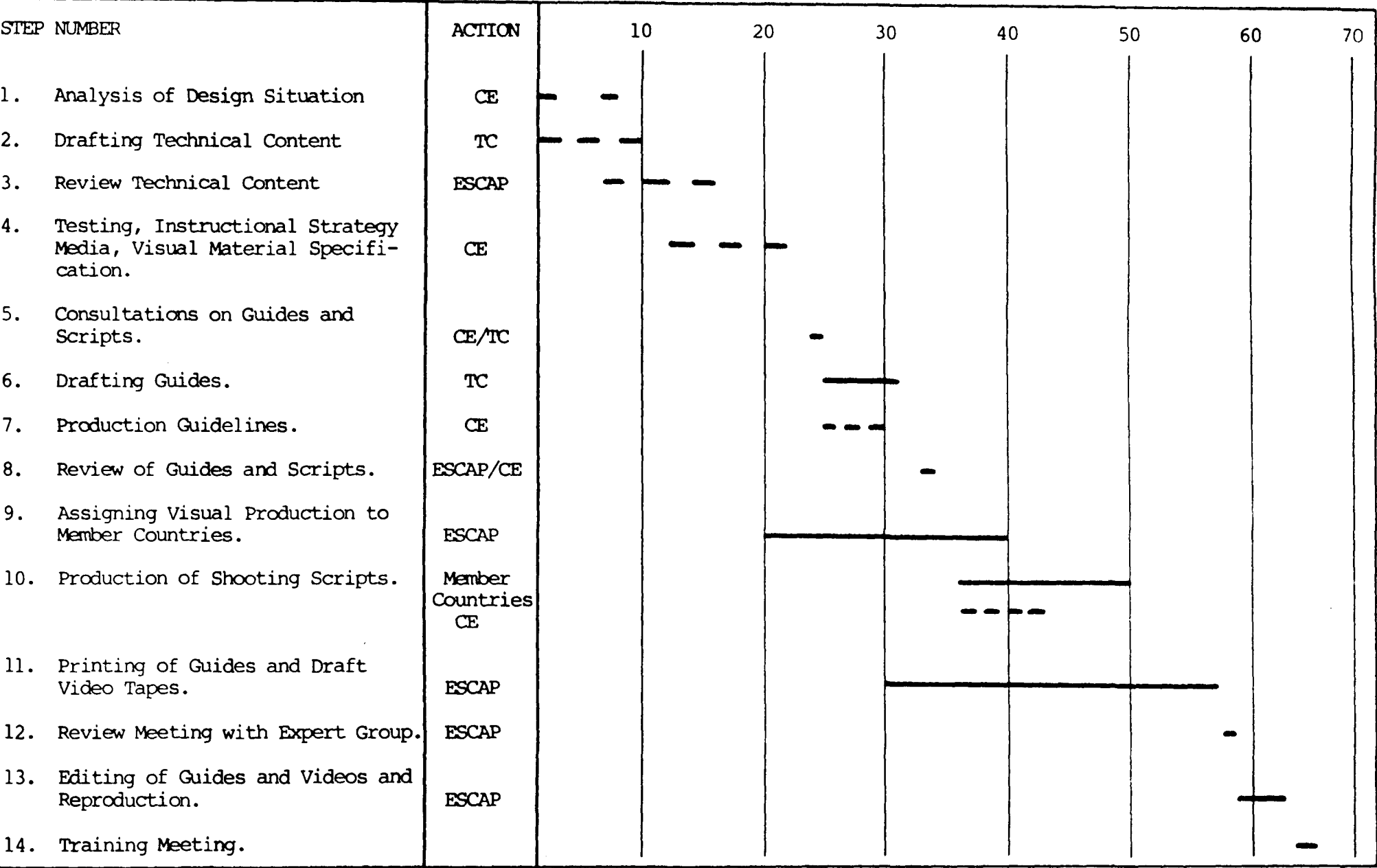
¹ CRRI reported that:

- their two modules took two months to produce;
- local (Indian) video production unit costs are estimated at \$5,000 for a 20 minute film unit inclusive of CRRI inputs.

ILO reported that:

- their two modules (1.5 hours) are estimated to have cost \$6,000-7,000 exclusive of ILO expert time;
- the studio produced (planning) module cost \$2,000-2,500 and took 1.5 months to make.
- one weeks video shooting in Thailand costs \$5,000-\$6,000.

Figure 5.1: Timetable of the Implementation Programme for Production of the Training Modules



**ANNEX 1: MEETING ON THE PREPAR-
ATION OF TRAINING MODULES
FOR RURAL ROAD CONSTRUC-
TION AND MAINTENANCE:
PROGRAMME AND LIST OF
PARTICIPANTS**

ANNEX 1: Meeting on the Preparation of Training Modules for Rural Road Construction and Maintenance: Programme and List of Participants

Programme

Wednesday, 25th February:

Opening of the Meeting

Introduction

Presentation of results from a survey on training needs in the ESCAP region

Presentation of existing training materials from:

India
Indonesia
The Philippines
Thailand
ILO
IRF

Lunch

Thursday, 26th February:

Discussion

Friday, 27th February:

ILO/PWD Thailand video training film on labour-based road construction (60 minutes)

Comments on presented video training films

Comments by IDRC consultants on their work to be undertaken

Miscellaneous

Closure of the Meeting

List of Participants

INDIA

Mr. T.K. Natarajan	Deputy Director, Central Road Research Institute, New Delhi.
Mr. N.B. Lal	Area Co-ordinator and Head, Soil Stabilisation and Rural Roads, Central Road Research Institute, New Delhi.

PHILIPPINES

Mr. Bienvenido S. Padilla	Chief, Manpower Development Service, Department of Public Works and Highway (Deputy Executive Director and Chief Operations Officer, Central Labour-Based Advisory and Training Team) (Executive Officer, DPWH Labour-Based Advisory and Training Team), Department of Public Works and Highways, Manila.
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THAILAND

Mr. Maitree Srinarawat	Project Director, Labour-Based Construction Project, Public Works Department, Ministry of Interior, Bangkok.
Mr. Santi Shinasharkey	Civil Engineer (7), National Highways Construction Division, Department of Highways, Ministry of Communications, Bangkok.
Mr. Visit Achayanontgit	Civil Engineer (7), Feeder Roads Construction Division, Department of Highways, Ministry of Communications, Bangkok.
Mr. Narong Achariyakul	Highway District Engineer, Udonthani Highway District, Department of Highways, Ministry of Communications, Bangkok.
Mr. Anant Vongphanich	Civil Engineer (7), National Highways Construction Division, Department of Highways, Ministry of Communications, Bangkok.
Mr. Boonchai Chitplee	Highway District Engineer, Prachinburi Highway District, Department of Highways, Ministry of Communications, Bangkok.
Mr. Dumri Thaikam	Civil Engineer (Level 7), Survey and Design Division, Office of Accelerated Rural Development, Ministry of Interior, Bangkok.

Mr. Kriengsakdi Pornlertnakarine	Civil Engineer (Level 7), Construction and Maintenance Control Division, Office of Accelerated Rural Development, Ministry of Interior, Bangkok.
Mr. Chalit Wongwanich	Technical Rural Development Officer (Level 7), Technical Services Division, Office of Accelerated Rural Development, Ministry of Interior, Bangkok.

SPECIALISED AGENCY

International Labour Organisation (ILO)

Mr. M. Grisay	Special Public Works Programme Officer, ILO ROAP, Bangkok.
Mr. Yap Tjay-Koen	Appropriate Technology Officer, ILO ROAP, Bangkok.
Mr. J.J. de Veen	Construction Technology Adviser, Technology and Employment Branch, Employment and Development Department, ILO Headquarters, Geneva.

OTHER ORGANISATION

Transport and Road Research Laboratory (TRRL)

Mr. R. Robinson	Head of Information Section, Overseas Unit (TRRL) Department of Transport, United Kingdom.
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SECRETARIAT

Mr. Fachri Mahmud	Chief, Transport, Communications and Tourism Division.
Mr. V.N. Gusev	Economic Affairs Officer, Transport, Communications and Tourism Division.
Mr. G. Hilper	Senior Expert on Highways and Highway Transport, Transport, Communications and Tourism Division.
Mr. Richard F. Lewis	Consultant, Transport, Communications and Tourism Division.
Dr. J.D.G.F. Howe	Consultant, Transport, Communications and Tourism Division.

**ANNEX 2: REPORT ON THE TRAINING
NEEDS OF STAFF ENGAGED IN
RURAL ROAD CONSTRUCTION
IN MEMBER COUNTRIES OF
THE REGION.**

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

Bangkok, Thailand

REPORT

on the training needs of staff engaged in rural road
construction in member countries of the region

1986

The views expressed in this report are that of the writer and do not necessarily reflect those of ESCAP Secretariat. The report has been issued without formal editing.

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1. INTRODUCTION

1.1 General

1.2 Objectives

1.3 Methodology

1.4 Scope of the report

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2.2 Indonesia

2.3 The Philippines

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4. ADDITIONAL OBSERVATIONS

5. RECOMMENDATIONS

PREFACE

The report presents the findings of a survey undertaken by the ESCAP secretariat utilizing the services of the consultant, Mr. T.K. Natarajan (Dy. Director, CRRI, New Delhi) and funded by the Federal Republic of Germany to assess the existing facilities and evaluate the future needs of some of the member countries of the ESCAP region concerning the training of local-level field officials who are involved in the actual work of rural road construction and maintenance.

The recommendations born of this survey should serve as a frame-work for further deliberations required to delineate the lines of further action relating to the joint ESCAP-IDRC project on the development of a set of modular teaching aids towards a "training course for local-level officials on rural road construction and maintenance" to be funded by the International Development and Research Centre (IDRC) Canada, due to begin in the next few months.

The survey has unmistakeably brought out that there is a distinct need for organized institutional arrangements in every agency or organization entrusted with the task of rural road construction and maintenance in order to ensure a modicum of quality in training at the grass-roots level. This, in turn, calls for the provision of structured audio-visual learning packages. Video films painstakingly produced, carefully scripted with well-thought-out commentaries, such as are being envisioned in the proposed modular teaching aids, will doubtless enhance the outreach of manpower development on the part of the various highway/rural road departments and ministries, through out the ESCAP region.

It is indeed gratifying to note that many senior officials of the governments of member countries have enthusiastically responded to the ESCAP project during the course of the survey and are willing to assist the ESCAP secretariat in a spirit of co-operative endeavour.

Bangkok
May 1986

Fachri Mahmud
Chief
Transport, Communications
and Tourism Division

1. INTRODUCTION

1.1 General

The ESCAP is planning to implement a project on the preparation of a trainers' training course for local level officials on rural road construction and maintenance in 1986-87. The work will entail the development and preparation of a master set of training modules on rural road construction and maintenance to cater to the training needs of the junior field staff (like foreman/supervisor) actually engaged in rural road works. This project will be funded by the International Research and Development Center (IDRC), Canada and the project work is scheduled to begin by August 1986, subsequent to the signing of the grant memorandum.

Prior to undertaking the project, the ESCAP secretariat considered it appropriate to conduct a survey on the existing training facilities and programmes and evaluate the future training requirements of the member countries of the ESCAP region and also enlist their co-operation in order to be better able to formulate the lines on which the proposed project should be organized.

1.2 Objectives

- a) to evaluate the existing facilities, training material, equipment, teaching aids etc. already available
- b) to evaluate the future training needs for various levels of staff
- c) to analyze the data, identify the target group most in need of training and recommend the nature and content of the training modules to be prepared during the course of the proposed ESCAP project

1.3 Methodology

Already, the ESCAP secretariat had conducted a study in 1981 concerning the different aspects of planning, design, construction and maintenance of rural roads in which six member countries had participated. The ESCAP secretariat had also subsequently brought out two manuals, one on rural road construction and the other on rural road maintenance. By way of supplementing the information already available, a survey was undertaken in some four selected countries of the region viz., India, Indonesia, the Philippines and Thailand, representing countries with a range of practices between the labour-based and the equipment-based, having different organizational set-up, with training facilities organized at different levels of efficiency, but all of them more or less sharing a sense of concern for augmenting their institutional arrangements towards providing a more intensive training programme for their field staff engaged in road works.

Senior officials/engineers concerned with roads in general and rural roads in particular and also those concerned with training programmes were personally contacted and discussions were held. The teaching aids, lecture notes, slides and other audio-visual aids that were available, were carefully studied. The course content of the existing training programmes was noted down. Suggestions were invited as to what kind of further assistance would the countries concerned like to have from the ESCAP in regard to their future training needs. Experts from the regional I.L.O. office also participated, so far as the Philippines was concerned. Views were elicited with regard to the ESCAP secretariat possibly drawing upon selected film shots/slides etc. that are already available in particular countries, in the prosecution of the proposed

/project,

project, so as to economize on time and effort and to give a 'regional' setting to the video films/visuals, thereby rendering them able to transcend the 'country-barrier' to the extent practicable and rendering them more easily acceptable to the various countries having somewhat divergent practices.

The country reports are briefly set out, followed by an analysis of the data so as to arrive at a broad consensus concerning what should be the scope of the proposed project, considering the region as a whole and finally setting forth recommendations on the number, nature and content of the training modules and other related aspects.

1.4 Scope of the report

Based on the data collected during the survey, the report attempts to answer such questions as:

- a) Who should be treated as the target trainees?
- b) Is it feasible to prepare teaching aids appropriate to all levels of local staff within the time and funds available? What should the priorities be like?
- c) What should be the desirable mix in the preparation of the various training modules between the different possible modes viz., lecture notes, slides, video films, field demonstrations and laboratory practicals?
- d) What should be the number, nature and content of the modules?

Additionally, some suggestions are offered with regard to other general aspects such as the lines on which the project may be implemented.

The suggestions made are meant to be further deliberated upon in the coming months in order to shape them up further into final decisions. For this purpose, consultative meetings with experts, consultants, representatives from member countries etc. are envisaged.

INDIA

2.1 Discussions were held with several high-ranking officials and engineers both at the centre and at the State P.W.Ds/Highway Departments. Some of the organizations consulted were:

Ministry of Transport, Govt. of India

Central Road Research Institute, New Delhi

Ministry of Rural Development

Different State Highway Departments/P.W.Ds

Rural road development has become a matter of growing urgency from considerations of social justice and economic uplift. The majority of the population lives in the rural areas and constitutes the weakest section of the society. According to the definition of the Indian Roads Congress, Other District Roads (ODRs) and Village Roads (VRs) constitute the rural roads network. While ODRs are feeder roads serving the rural areas of production, providing them with an outlet to the market centres, Vrs are roads connecting villages and groups of villages with another or to the market centre and/or with the nearest road of a higher category.

A national "minimum needs programme", was introduced during the Fifth Plan (1974-79) envisaging the allocation of larger resources for the social consumption of all areas in the country, the objective being to establish a network of essential services on a co-ordinated and integrated basis, given certain pre-determined criteria of uniformity and equality. Rural roads were accorded an important place in the minimum needs Programme, the objective being that all villages with a population of over 1,500 and above will be connected with all-weather roads by the end of Fifth Plan. In hilly tribal or coastal areas,

where the population is relatively dispersed, the idea was to go by a cluster of villages of like size. However, due to paucity of funds, the objective has not been fully realized thus far and the present accessibility levels are quite low. At the same time, the existing road network includes about 550,000 km of regular rural roads and another about 450,000 km of rural roads constructed under the community development programmes, national extension scheme etc. which are mostly unsurfaced. This network itself would involve sizeable investments and organizational inputs for its proper maintenance so that these roads are kept in a reasonable state of serviceability to traffic.

Multiple organizations involved

Due to the multiplicity of organizations engaged in rural road, construction, very often there is no organized attempt at quality control, uniformity in standards; nor in maintenance or upkeep of the roads, nor at the supply of maintenance funds. This is true of most states. Some states of course are at a higher level of efficiency with regard to organizational aspects.

The diversity in the modes of traffic, the solid-wheeled carts cutting deep into the pavements, the variety of climatic conditions, the type of surfacings, the inadequate organizational machinery-all combine to make the problem a formidable one. The lack of training on the part of the local level staff directly in charge of executing the road works aggravates the problem even further.

There is no organized attempt at imparting training to local level officials in most states. Of late, the Ministry of Rural Development has started organizing training courses to junior level officials collected from all over India (comprising mostly executive engineers, assistant engineers, overseers etc.) using the good offices of the Central Road Research Institute in New Delhi. Lectures are given

and demonstrations arranged by the scientists of CRRI. The duration of the course is 3-4 working days. The curriculum includes use of local materials in pavement construction, subgrade compaction, design of pavement thickness, drainage, tests for quality control, cross drainage works, surface dressing etc. No video films are used because none are available. There is one manual available, brought out by the Indian Roads Congress relating to Rural Road Construction and Maintenance, in the English language. However, some notes on what to do and what not to do are also being made available by the State Governments in their respective local languages such as has been done in Gujarat.

In the states, the Deputy Engineers and the Executive Engineers receive training in the engineering staff college, wherever such facilities exist. Assistant Executive Engineers are trained sometimes in the regional laboratories in the different zones or in the state engineering research institute, once in a year.

Categories of Staff

The following represents the categories of staff in most states with regard to the organizational set up concerning rural roads construction and maintenance:

Senior level officers

Category 1: Chief Engineer

Category 2: Superintending Engineer

Middle level Executive Officers

Category 3: Executive Engineer/Divisional Engineer

Category 4: Assistant Engineer/Deputy Engineer/Sub-divisional Officer

All the above categories of staff are graduates in engineering.

/Junior ...

Junior level technical staff

Category 5: Junior Engineer (this post is often held by a graduate engineer)

Category 6: Supervisor (occasionally called overseer)

The minimum qualification is a civil engineering Dipolma.

The above two categories of staff would actually constitute the local level officials.

Skilled labour

Category 7: Mate/foreman

(In some of the states, the minimum qualifications is Matric + ITI course)

Category 8: Mistry (works under the overall charge of the Mate)

Category 9: Mason, carpenter (works under the charge of supervisor/overseer)

Category 10: Mechanics, Operators, Road Roller Drivers etc. (works under the supervisor)

Unskilled labour

Category 11: Gangmen

Training programmes

There is a general expression of desire on the part of the state governments to enlarge their training programmes. No concrete blue print for action has been drawn up in most of the states consulted with. However, the Ministry of Rural Development in New Delhi is seized of the urgency of the problem and has seriously started initiating training courses drawing upon the infrastructural facilities available with the Central Road Research Institute.

No adequate training facilities exist in any organized manner in most of the states although the basic infrastructure can be mobilized in reasonable time with moderate effort. In some of the states like Tamil Nadu, Maharashtra, Gujarat etc. already steps have been taken to

impart periodic training to highway engineers and junior staff engaged on rural road construction but such training cannot by any means, be regarded as adequate.

A number of qualified engineers are available who can be easily trained into potential instructors from within the country; but they do require to be trained.

The maintenance requirements are likely to increase three-fold in the next 5-10 years in view of the increased outlay and work envisaged.

Some notes and guidelines have been prepared and are given to trainees. They are written in the local language. This is true of only certain states. Lecture notes are available with the CRRRI who use them when they conduct training courses to junior level staff engaged on rural road construction and maintenance.

The majority of the states employ labour-based technology. However, in a few of the states, the trend is towards switching to machine-based technology, especially when the works are executed under the aegis of the World Bank etc.

All the potential trainees will be from Panchayat Raj or Zilla Parishads of the various states entrusted with the responsibility for rural road construction and maintenance.

According to many of the chief engineers, a suitably designed mix of video-film, lectures, field demonstration and lab practicals should constitute the total teaching material.

The lectures/video taping should ultimately have to be brought out in the concerned local languages.

Special features to be included

Apart from the routine aspects of rural road construction and maintenance, the following aspects should also be included considering the wide variety of the prevailing soil and climatic conditions and the different types of road aggregates used in India.

- a) Erosion control techniques
- b) Use of bricks in road construction
- c) Soil-lime stabilization for sub-base course
- d) roads on black-cotton soils
- e) roads on peat/marsh/soft marine clay
- f) roads on hillsides
- g) roads in desert areas

/INDONESIA

INDONESIA

2.2 With a view to obtain data on the training needs of the different categories of staff engaged in rural road construction and maintenance, meetings were held with officials concerned with rural road development in the Ministry of Communications (including the Directorate General of Land Transport and Inland Waterways), the Ministry of Public Works, and with the Head of the Training Centre in the Directorate General of Bina Marga. The discussions centred around the organizational set-up, planning, design, construction, maintenance and training aspects relating to rural road development programmes in Indonesia.

Already on a previous occasion, visits had been made to typical sites of rural roads in different selected regions including roads in Bali which had given an opportunity to study roads first-hand over a wide spectrum of variables.

General

Indonesia with a population of about 136 million represents the largest muslim country in the world. It consists of 13,677 islands with a total area of about 1,904,000 sq. kilometres. The main islands are Java, Sumatra and Irian.

The transportation system in Indonesia consists of roads, railways, waterways, airways and coastal shipping between the islands, the total length of road network being on the order of 106,000 km. Kabupaten/municipal roads are about 68,000 km, the remaining length being taken up by national roads and provincial roads.

About 60% of the road network is classified as Kabupaten/district roads. The district road system generally functions as the feeder system to the national/provincial road networks.

The rural/feeder systems have roads of all grades of quality of surface, ranging from a good asphalted road to a poorly maintained earthen one. Transportation in rural areas represents a mix between the traditional means of transport and the modern ones. Traditional means of transport are portage, pack animals, ox cart and house cart. Modern means of transport include motorcycle, car, pick-up, mini-truck, mini-bus, bus and truck. Generally speaking, the composition of traffic on rural roads is still dominated by non-motorized vehicle and portage.

Organizational set-up

The overall planning and programming for nation-wide rural development including feeder roads are co-ordinated by the central government. The responsibility for the actual execution of the feeder road projects, however, rest at the provincial and the Kabupaten levels. The principal organizations at the provincial and the district levels associated with rural roads are the provincial and the Kabupaten Public Works Department, specifically the Directorate General (Highways), Bina Marga. The ministries and the agencies at the Centre having the greatest involvement in rural roads are the National Development Planning Board (Bappenas), the Department of Public Works (DPU) and the Ministry of Home Affairs (MHA) owning the rural roads and the Directorate General of Land Transport undertaking the planning. The Ministry of Home Affairs has overall responsibility for the Impres Jalan programmes which are the principal source of funds for rural roads.

Of the various training institutions, those with the greatest impact on training associated with rural roads are the DPU central training centres and the regional training centres. The centres are designed to provide limited 'in-house' and yearly 'on-site' training to the provincial and district engineers.

The design standards adopted at the Kabupaten level differ from place to place for no valid technical reason. Very often technical officers have no more than a certificate obtained from the technical school and naturally without the benefits of systematic training in rural road engineering they cannot be expected to live up to the job requirements of determining the pavement composition and thickness in a given location under a given set of conditions. Thus the need to systematize training facilities at the grass-roots level is urgent.

Maintenance activities on rural roads are carried out once a year depending on the degree of distress exhibited by the pavement and based on the availability of funds.

Training needs

The special features to be kept in view while framing a training program for rural road local-level technical staff are: the use of limestone in road construction, use of soil stabilization techniques, road construction in marshy areas etc.

In order to ensure effective quality control in rural road construction, training programmes organized at both the Kabupaten and at the village levels, should be intensified.

One fact that emerges clearly is that although there are attempts at imparting training, the basic infrastructure facilities required for organizing regular, periodic and planned training programmes adapted to rural road engineering requirements by having a regular staff of instructors, are yet to take full shape, inspite of the existence of the Training Centre under the Bina Marga Directorate. Much of the present training programmes are dependent on the provision of a component for such training as part of the project works and the training is invariably given by the consultants associated with the project.

Training facilities are now available at the regional level, at least with regard to some regions and it is expected that the other regions also will have periodic training programmes conducted in the years to come. One also gets the impression that the multiplicity of organizations involved like the Home Affairs, Ninay Marga, Land Transport, Kabupaten organizations etc. makes co-ordination rather difficult, rendering the organization of systematic training programmes, a matter of some difficulty. The activities of the Training Centre have yet to reach a self-sustaining level.

The Training Centre in the Department of Bina Marga has a good library of slides (many of them rather old) and an impressive set of video cassettes prepared in Japan originally and later dubbed in the Indonesian language. Most of the video cassettes (about 80 in number) were seen not to cater to rural road requirements as far as design, planning, construction or maintenance aspects are concerned. They relate to such topics as maintenance of bull dozers, diesel engines, trucks, crawlers and related mechanical aspects of operation. Another series concerns itself with power tools, drills, use of hand tools etc. Some of them relate to bridges and prestressed concrete works and runways. However, the "slide cum audio tapes" were found to be more pertinent to at least some aspects of rural road engineering. The topics covered are asphalt or bituminous surfacings, CBR tests, foundation investigations, drainage, plants and equipment and materials used in road construction and maintenance in general. Some of these slides should therefore be as relevant to rural roads as they are to roads in the general category, including provincial roads etc. It seems likely that a careful search may yield some relevant slides which can be made use of in the implementation of the ESCAP project.

This will save on time required to prepare the overall raw material prior to final shooting and another advantage will be that some shots having the Indonesian setting when appropriately incorporated into the body of the teaching modules will provide the require 'regional' perspective to the final product as far as the visuals are concerned.

The officials were appreciative of the proposal to make special teaching aids for training relating to rural roads on the part of the ESCAP which would be very helpful in augmenting the existing infrastructural training facilities in Indonesia.

THE PHILIPPINES

2.3 During the visit of the ESCAP mission for the survey of training needs of local level field staff engaged on rural road works in the Philippines, meetings were held with several senior officials of the concerned Ministries and departments such as the Ministry of Public Works and Highways; the staff of the Manpower Services Division; Director and Senior Adviser (Rural Roads) of the regional ILO office in Manila.

General

The Philippines is an archipelago consisting of 7,107 islands with a total land area of some 300,780 sq km. Presently, it is divided into 12 regions, 60 cities, 72 provinces, 1,422 municipalities, 21 municipal districts and 40,500 barangays (villages). Rural roads are known as barangay roads in the Philippines.

Road classification system

The roads are classified into five categories viz: national roads (classed as national primary and national secondary roads); provincial roads, city roads; municipal roads and barangay roads.

Barangay roads amount to about 100,000 km out of the total road network lengths of about 155,000 km and are those roads outside the urbanized areas of a city or public areas in a municipality, serving as feeder or farm-to-market roads, and not classified as either national or provincial roads.

Rural transport system

The rural transport system consists of inland water transport and a rural road network comprising barangay roads. For the rural transport system the development strategy centres around:

(a) intensive construction of feeder and farm-to-market roads which will branch out from completed highways;

(b) paving and rehabilitation of existing trunk lines and secondary roads, and reconstruction of bridges;

(c) construction and improvement of feeder roads linking farms and fishing villages to highways and markets; development of roads leading to resettlement areas and penetrating hinterlands traversing agricultural and industrial resources.

It is believed that these facilities will serve as a unifying medium by bringing people living in isolated and far-flung areas into the mainstream of social and economic activity.

Organizational set-up

The Ministry of Public Highways till about 1981 was the main ministry to be concerned with the development of rural roads. In July 1981, the Ministry of Public Highways was merged with the Ministry of Public Works for the sake of simplicity and economy in operations.

With its present set-up, the Ministry of Public Works and Highways (MPWH) has several government corporations attached to it for the case of administrative supervision and programme co-ordination. All the service divisions, bureaus and similar agencies, regional offices of the two former ministries of Public Works and of Highways have been since 1981 transferred to the new Ministry of Public Works and Highways.

Five staff bureaus function under the supervision and control of the MPWH. They are:

- 1) Bureau of Design
- 2) Bureau of Construction
- 3) Bureau of Maintenance
- 4) Bureau of Equipment
- 5) Bureau of Materials and Quality Control.

The Bureau of Construction has a Division devoted to Barangay roads. The Division works for promoting the development of the countryside by the construction of rural roads. The staff of the Division working on rural road construction has a technical or engineering background in their education.

Design, construction and maintenance aspects

In general, roads are upgraded to standard called for by traffic densities and road usages as projected. No major realignment is done because of the high cost involved. Roads are widened (with minor embankments in low-lying areas) using a bull-dozer followed by surfacing and shaping of the formation by a motor grader and compaction with a towed roller. One of the two existing general design standards is invariably adopted.

The construction technology used in relation to barangay roads is normally machine-based. Power rollers are normally adopted for the compaction of the fill and subgrade, although a shortage of rollers occurs occasionally.

Barangay roads are maintained by the barangay councils in co-ordination with the Highway District Engineers' Office/City engineers' office.

The most common activities in the maintenance of barangay roads are: (a) cleaning and repairing of pipe culverts, ditches and other drainage facilities (b) vegetation control (c) surface repair of potholes, ruts etc. (d) replenishing surface materials (e) placing of surface materials over unsurfaced roads (f) minor repairs of bridges and other structures (g) repairs necessitated by landslips (h) machine blading of road surface and shoulders of a grader is available (i) erosion and scour control.

There is a limited amount of mechanized equipment available for use in barangay roads. When mechanized equipment is not available, labour-based methods are employed.

Training needs

The Manpower Development Services Division of the MPWH is in charge of organizing training courses appropriate to all levels of staff, both technical and non-technical. The courses vary in duration between a few days to about a week. The Ministry of Public Works and Highways has brought out a catalogue of audio-visual courses in December 1983 for upgrading and updating the technical knowledge and the technological skills of the various members of technical staff.

Slides synchronized with audio-cassette-recording of commentary are being widely used. However, there is a strong feeling that video films would be even better and it was stated that the present thinking is to go in for video taping.

Upon viewing some of the slides projected and scrutinizing the list of topics on which video tapes are available with the Manpower Development Services Division of MPWH, it became apparent that the a/v were not specifically designed to cater to rural road aspects. However, even if the a/v aids are mainly directed towards higher categories of roads, there still are available, topics like investigation, materials testing, maintenance etc. which are largely applicable to rural roads as well. Accordingly, it would appear prudent to draw upon some of the slides and try to incorporate them into the body of the proposed video films by using the good offices of the Ministry.

The Junior technical staff in charge of actual road construction and maintenance is designated in the Philippines as 'civil engineer' or 'associate civil engineer'. The officials of the MPWH are of the

view that there is a distinct need for bringing out such teaching modules initially in English and subsequently in the local dialects and specially adapted to rural roads in order that they could be put to effective use. It was suggested that priority should be given to the training needs of 'associate civil engineer' who is equivalent in rank and functions, to the 'foreman', 'supervisor' category of staff in certain other countries.

Likewise, the regional ILO office has some slides available with them which could also be drawn upon in the course of the implementation of the proposed project.

It became clear during the discussions that as a result of the efforts of ILO and a change in the outlook of the new government, there is a perceptible and increasing trend towards switching to labour-based technology at least with respect to rural roads in future years.

It would therefore be desirable to attempt to have both types of technology covered in the video-films and lecture notes so as to cater to the varying needs of countries of the region.

THAILAND

2.4 Discussions were held with various high-ranking officials and engineers of the Department of Highways of the Ministry of Communications and of the Department of Public Works of the Ministry of Interior. The Director General of the Department of Highways took keen interest in the proposed project details of ESCAP and promised to extend all possible assistance in the preparation of the teaching modules. The proposal was also discussed in detail with other senior officials (Directors) concerned with Planning, Maintenance, Training and other aspects as well as with the Department of Public Works who provided the relevant information on their plans, programmes and policies and evaluated their future training needs with respect to different categories of roads including rural roads.

Data collected from previous studies and through such consultations as indicated above form the basis for the observations made in this sections of the report.

General

Thailand with a population of nearly 50 million has 72 provinces, 600 districts and 5,666 sub-districts and a variety of terrain conditions.

Thailand's total road network amounts to about 160,000 km, out of which 45,000 km are administered by the Highway Department. Only about 25% of HD's roads are still laterite/gravel roads.

The majority of the remaining 115,000 km falls under the category of rural roads.

Organizational set-up

Besides the Ministry of communication with its Highway Department, the Ministry of Interior with both Public Works Department's Rural Road Division and the Office of Accelerated Rural Development are mainly involved in rural road construction. Furthermore, the Mobile Development

Unit as a paramilitary unit, the Royal Irrigation Department and the Community Development Department are also engaged in rural road construction.

Several classes of rural roads are built like the village access road type 1 and 2.

PWD has recently emphasized labour-based road construction under ILO assistance and funded by UNDP. The labour-based concept is also promoted by the rural job creation programme, for which funds on the order of 2,000 million \$ are released per year.

Design and construction aspects

There is not much of traffic in rural areas. The traffic consists of small vehicles, pick-up trucks, motor cycles and animal-drawn carts. Irrespective of the volume of traffic, all agencies adopt uniformly the standards of provincial roads formulated by the Department of Highways comparable to similar categories such as F5 etc. indicated in the standards.

With regard to the rural roads constructed by PWD there appears to be some scope for a somewhat stricter approach for adopting the principle of stage construction. In other words, some of the rural roads which have very little traffic on them can well afford to have a lesser thickness of pavement than is being provided (based on any rational design method) and the thickness can be subsequently built up, as and when the traffic volume increases. Some economy is possible in this direction.

Earthwork for embankment is generally compacted in layers not exceeding 20 cm loose thickness to 95% standard AASHO density. At culverts or bridges where heavy compaction equipment cannot operate, vibrators and forge hammers are used.

Most of the unpaved roads in Thailand including ARD roads are constructed with laterite surfacing. Laterite is usually found within leads of 15 to 20 km from the sites of construction, normally. Laterite is laid in two layers of 10 cm thickness and each layer is compacted to 95% modified AASHO density.

As of the present day, the technology employed for construction has been equipment-based.

Training needs

Seminars are organized annually catering to the training needs of administrative and managerial officials and other categories of staff. With regard to the training of local level field staff on rural road construction and maintenance, the Department of Highways and the Department of Public Works were very much appreciative of the need for such teaching modules as are proposed to be brought out by ESCAP.

It was felt that staff at the junior most technical level in the field normally designated as Technician 1 or Technician 2 invariably obtain a certificate from a technical school after 5 or 3 years of study (subsequent to completing his high school studies) depending on whether he is technician 1 or technician 2. The officials were of the opinion that the ESCAP should initially focus on the training programmes appropriate to the needs of such 'technicians' who would correspond to the 'foreman' in the engineering parlance of certain other countries of the region.

An overall estimation of the number of various levels of local staff by the HD's staff, gives a figure of about 5,000 technicians I and II in civil and mechanical engineering, 700 engineers, 15,500 permanent employees and 18,000 casual labourers. The technicians are

either responsible for the supervision of construction work carried out by contractors or working as supervisors in the 10 construction centres of HD, which work on force-account basis and act also as on-the-job training facilities.

PWD has a work force of about 500 operating in 35 provinces, out of which 300 technicians have been already trained at its training centre in Ayuthaya. But with the planned extension of labour-based road works, more trained technicians are urgently required.

PWD has already produced video-films which aim at promoting labour-based road construction work. Collaborating with the PWD authorities in producing videos of labour-based work on rural roads under construction in Thailand is therefore indicated in the context of the present project.

During the discussions, it transpired that Thailand would continue to use equipment-based technology for the construction of the higher categories of road pavements whereas there is a distinct trend discernible to switch over to more of labour-based technology or a suitable mix of both types of technology in respect of rural road construction at the village level. This is seen to be especially in tune with such schemes as the "Rural Job Creation Programme" which places the accent on the employment potential of the road project combined with the requirements of durability of the road. Training at the grass-roots level for the local staff directly engaged in rural road construction is therefore of great significance. It is also apparent that both types of technology deserve to be portrayed in the overall preparation of the proposed teaching modules.

Soil cement stabilization technique is often used. Lime stabilized soil technique is not used because of the scarcity of lime for road construction purposes. It was also suggested during the discussions that as far as the syllabus relating to rural roads are concerned, there is no need for including the topic of "bituminous surfacings" in the syllabus. Other special aspects which should be given consideration while formulating the syllabus are: hill roads, landslides and embankments on soft ground.

3. THE FINDINGS

3.1 There is a distinct need in most member countries of the region, for augmenting institutional arrangements towards organizing systematic training programmes appropriate to the needs of local level officials (junior engineer, foreman, overseer, lab. technician, materials engineer etc.) engaged in rural road construction and maintenance.

3.2 In most countries of the region, except for 2-3 countries that provide a notable exception, the local level officials do not receive organized training. In some countries who do organize training programmes, there is seldom any course especially adapted to the requirements of rural road engineering practice.

3.3 In the Philippines, a well-drawn-out programme of training for road engineers, administrators, foreman (mates) and the unskilled labour does exist, based on an impressive array of audio-visual teaching aids (slide projection synchronized with audio-taped commentary). They relate to roads in general and do not cover many important aspects peculiar to rural road construction. Nevertheless, some aspects have been covered and these aids may therefore be drawn upon in the course of the preparation of the teaching modules in the proposed ESCAP project, if found perchance useful. The Manpower Development Services Division of the Ministry of Public Works & Highways of the Philippines who prepare these aids and organize the training programmes, are themselves proposing to update these slides and are keen to switch over to video films as a teaching aid.

3.4 Apart from recognizing lecture notes as an inevitable teaching aid to the trainer, most officials in many member countries unmistakably favoured the idea of introducing video films with commentary as a singularly useful teaching aid, sometimes as complementary to lecture notes.

3.5 There is evidence of a growing sense of serious concern, in many countries, on the part of senior officials of organizations involved in rural road construction and maintenance, that there is a felt need for organizing training facilities in a more systematic manner and many of the officials expressly stated that the efforts of the ESCAP in the preparation of the proposed teaching aids will be a major step in the right direction.

3.6 The technologies adopted by many countries are largely labour-based. A few countries are adopting somewhat machine-based technology. There are one or two countries (or particular regions or states within a country where the concerned government agencies dealing with rural roads tend to switch over from machine-based technology to labour-based technology because of a shift in policy, with a change in the government. On the other hand, there are cases where countries/states who are presently practising labour-intensive technology, are deliberately changing over, surely but slowly, to equipment-based practices, as and when their continually expanding resources permit.

3.7 In India, some particular state public works departments, highways departments or rural road construction agencies in panchayats or zilla parishads, annually conduct training courses to junior level staff engaged in rural road works. No lecture notes are uniformly available. Some state governments, however, have simple guidelines brought out in the local vernacular, for use by their mistry/mate. No other type of audio-visual teaching aids are used as a routine. Many of the states are lacking in organized training programmes. However, the Ministry of Rural Development at the centre, is seized of the problem and have recently begun organizing a series of workshops in New Delhi drawing upon the good offices of the Central Road Research Institute. The

The duration of the workshop is about 4 days. No audio-visual aids are used in particular. Specially prepared lecture notes are made available, field demonstrations arranged and lab. practicals conducted. Local executive engineers, asst. engineers, junior engineers, overseer from rural road agencies in the districts/panchayat raj/zilla parishads mostly comprise the trainees.

3.8 Judged from the prevalent practices in different member countries, there is a wide spectrum of pavement types, materials, climate and terrain to be catered for. Landslides, building of roads on marsh and swamps, use of brick ballast and pavement, use of water-bound macadam exemplify the needed comprehensiveness in the course content, considering the region as a whole.

3.9 Training programmes are required to be designed to cater to many categories of staff like the executive engineer, the asst. executive engineer, i.e. the middle level executives and to the local level staff at the lowest technical level viz., the junior engineer, foreman, overseer, supervisor, inspector, the 'asst. civil engineer' or 'civil engineer' as variously designated in different countries. The need for training mates/mistries/operators/mechanics was expressed. Another category that requires training was stated to be materials engineer/lab. technicians/lab. aides etc.

3.10 It was generally felt that the senior level officers and the middle level executives do receive the benefits of a systematic engineering education and have some years of accumulated experience and occasionally attend refresher courses, whereas the junior local level officials and the new recruits invariably remain untrained or inexperienced and are therefore the ones who would seem to be most in need of training, especially considering the fact that they are the ones who are in responsible charge of actual construction and maintenance work in the field.

4. ADDITIONAL OBSERVATIONS

4.1 A/V aids are normally not meant to eliminate the need for a lecturer, nor even the lecture notes, but in fact to complement the lecture notes and provide the needed stimuli that normally accompanies any audio visual presentation, as compared to mere oral presentation.

4.2 Video-film presentation would seem to have an edge over slide projection with synchronized audio-taping commentary. The reasons are:

- a) slides synchronized audio tapes require projectors not readily available in most countries and are rather costly since they would have to be imported; b) for projecting video films, VCRs and locally made TVs are readily available. Even VCPs should suffice. The departmental heads are of the opinion that it will not be too much for the government to invest on sufficient number of such equipment and make provision in the budget; c) the video tape is relatively more compact and easy to carry about and one tape can compress into itself many topics of interest; d) shots depicting action, construction procedure, nuances of movement involved in labour-oriented manual practices will have a special appeal in a video film which a transparency cannot so effectively delineate.

However, there is no denying that slides with synchronized audio-tape have certain other advantages. They may be less expensive to produce. Where lots of graphs, charts, tables, numericals etc. require to be depicted and where such shots require to be projected long enough for them to be watched, read or assimilated in the viewers'/trainees' conscious mind and where the time lapse required to keep a slide on is long enough to match with the length of commentary presented, and where a particular slide giving a table of specifications has to be held still to permit clarifying cross-discussions between the trainee and the trainer-- in all such instances, the mode of slide projection appears convenient

/enough.

enough. When action shots such as are involved in test procedures, construction and maintenance practices are to be presented, video film is doubtless preferable. In order to combine the best of both, certain sequences involving a predominance of charts, tables of specifications and numerical data might advantageously be shot in colour slides, commentary taped and synchronized and the whole absorbed finally by a video camera. In other sequences where shots of construction or maintenance practices or laboratory testing are to be included, the video camera be directly used for such filming. Further thought may be given with regard to the feasibility or meaningfulness of such a proposal.

4.3 The modules for teaching aids in the proposed project have been planned with a full realization of the fact that a module or all parts of a module may not necessarily lend itself for video-filming and that the syllabus/technical content of each of the modules should be thought out first, oblivious of the mode of presentation, viz., lecture notes, slides, videos, field demonstration or laboratory practicals; that only subsequent to formulating the syllabus for each module should the particular mode of presentation which seems best suited be picked out and assigned to the different parts of the module, either singly or in combination.

It would appear that the video component finds a special place only in some of the modules. In many others, lecture notes with ordinary slide projection would appear to be the most appropriate mode of presentation.

4.4 Although a number of modules can be thought of to cater to the specific needs of different countries, from considerations of practicability and constraints of time, effort and money, a standard set of a minimum number of modules has been designed which can be suitably added upon or later edited so as to cater to the special requirements of any particular country.

5. RECOMMENDATIONS

The recommendations set out below are based on an analysis of the data gained from ESCAP report on the study on rural roads construction and maintenance in 1980-81 covering some six countries of the region (Indonesia, Bangladesh, Nepal, the Philippines, Sri Lanka and Thailand) and the data collected during the present survey covering India, Indonesia, the Philippines and Thailand. The reasoning behind the recommendations is partly reflected in the observations made in the Art. 3 and Art. 4 of the report.

The recommendations are to be regarded as tentative and an aid in the decision-making process. They are meant to be deliberated upon further and brought to a higher pitch of refinement before they can be regarded as definitive.

For the modules suggested, only an outline of the syllabus (Art. 5.13), has been presented. The details will be worked out in greater minutiae, once the number, nature and broad technical content of the modules are finalized.

5.1 Top-most priority should be given to the training of local level officials (junior level technical staff) directly involved in rural road construction and maintenance. This category will include foreman, overseer, supervisor, junior engineer, site engineer, technician, 'civil engineer', 'asso. civil engineer', etc. as may be variously designated in the different countries. Training Programme I has been designed to cater to this level of staff and the corresponding set of modules are presented together with an outline of the syllabus or course content in Art. 5.12 & Art. 5.13. The participants should have a minimum of a technical certificate in civil engineering subsequent to his high school education with some field experience. The duration of the programme is 2 weeks.

The modules represent a basic set of individual themes that together constitute the training programme. If special or additional requirements are considered desirable or appropriate to cater to, by any particular member country, such a requirement can be fulfilled by preparing a new supplementary module or by simply adding additional features as part of the relevant module already prepared (lecture notes or video or both) as may be deemed suitable.

5.2 Training Programme II has been designed to cater to the materials engineer, quality control staff, lab. technician etc. The duration of the programme is 1 week. A few selected modules out of Training Programme I should be sufficient to cater to the needs of Training Programme II. Accordingly, no special modules would have to be prepared additionally so far as Training Programme II is concerned. The relevant modules are set out at the end of this section, viz in Art. 5.12.

Training Programme III has been designed to cater to construction inspectors, materials inspectors, lab. aides etc. The participants should preferably be a graduate in science or have a degree or diploma in civil engineering. The duration of the programme is 4 days. The modules relate to the work of inspection of the various completed phases during construction and are listed as 'inspection series' set out in Art. 5.12.

It is recommended that ESCAP in its proposed project should concern itself only with Training Programme I (which, in its turn, encompasses the needs of Training Programme II as indicated in para 5.2 above). Training Programme III may be accorded a lower priority and may not be taken up presently. An outline of the syllabus for Training Programme III has therefore not been presented.

The indicated modules for Training Programme I will have a mix of lecture notes, videos, field demonstration and lab. practicals. The proportion of the mix for each individual module has been decided upon depending on the interplay of factors such as the technical content, nature of material to be depicted (whether the module calls for action portraying practices and procedures of construction or calls for graphs, drawings, charts, specifications etc.). The appropriate mode has been tentatively indicated in Art. 5.13, such as lectures, video films, field demonstrations or lab. practicals or particular combinations of these, using symbols L,V,D & P respectively.

5.3 When describing construction practices/procedures, both labour-based and machine-based technologies should be covered/depicted in the lecture notes as well as in the video shots.

5.4 It would seem worthwhile to spend time (say 1 week) at a later date and identify the material appropriate for possible inclusion in the proposed teaching aids (especially visuals) by means of a careful scanning of the stock of slides available with the Training Centre at Jakarta and with the Manpower Development Services of the MPWH of the Philippines in Manila to selectively incorporate them into the body of the video films proposed to be prepared. Likewise the other materials like lecture notes, photographs and laboratory facilities etc. available with CRRI, New Delhi, may be availed of in the course of the work. Slides available with the officials of the regional office of ILO in Manila relevant to rural roads may also be drawn upon, if found useful. These slides should be got scanned, their relevance to the present project evaluated and means of incorporating them devised. It is likely that about 50 slides may prove to be pertinent in the final analysis. To an extent, it will help to economize on time, effort and money which would otherwise be needed.

Video shots already available with the PWD in Thailand and those yet to be filmed on PWD's rural road projects and the Department of Highways road projects, planned for construction in the coming months, should also be incorporated.

5.5 While preparing the video cassettes, consideration should be given to the fact that some countries normally use the SONY Betamax System whereas other countries normally use the VHS system.

5.6 The advisability of arranging only one regional workshop for the trainer's training programme (instead of the two planned originally) may be considered if the budget proves too tight to allow of parts of the video filming to be done in two or three countries and subsequently edited/integrated into one whole.

5.7 The Central Road Research Institute, New Delhi, may be requested to organize the sequences based on a well-thought-out script to be finalized by ESCAP for a planned programme of video filming. Many shots of different sets of road lengths under construction and practices to be demonstrated would have to be organized and enacted in advance preferably on the piece of land adjoining the CRRI building on a full field scale. Other such possibilities in other countries may also be examined.

5.8 The Mass Communication & Research Centre of the Jamia Millia University in New Delhi, in close proximity to CRRI, are known to possess a unit (presumably funded by UNESCO/UNDP) with a whole range of professional equipment for video film production including modules for computerized editing. They have competent members of staff with specialized experience in the preparation of documentary films and video teaching aids for the ministries of the Government and the Universities. They are a non-profit-making agency. The possibility of utilizing their services should be explored.

5.9 Any agency entrusted with the job of video-film production and editing should also be given the responsibility to subsequently re-arrange and re-edit as may be required for interposing selected additional video film strips or slides as may be foraged by the ESCAP secretariat and handed over to them in consonance with the finalized script.

5.10 The ESCAP had prepared two manuals concerning construction and maintenance of rural roads and in order to enable the member countries to put them to good use, a project on the preparation of teaching modules is being presently undertaken. In turn, in order to put the teaching modules to good use, the ESCAP might think in terms of inviting the kind attention of the Governments concerned with regard to the need to systematically organize periodic training programmes, conduct a simple test at the end of the course, give certificates upon the successful completion of the training course to the prospective participants and ensure that due weightage is given to such certificates of training as a pre-requisite to promotion to the next higher grade. Such a proposal may be mooted when the proposed workshop on trainer's training programme is conducted at the regional level.

5.11 Training programmes for highway officials in many countries often tend to be organized at the capital of the country or in the case of the state highway departments, in the capital of the State. However, as far as rural roads are concerned, it is considered appropriate, desirable and expedient to conduct the proposed training programme meant for the local-level officials in each of the districts, at least once a year, rather than conduct it in the urban or metropolitan areas. It would seem equally expedient to take advantage of the more

experienced and the more knowledgeable members (amongst the compeers who constitute the trainees) and train them to act as the trainers. Alternatively, qualified materials engineers or assistant executive engineers should be trained and entrusted with the job of conducting the training course. When the training course gets systematically organized as a routine, having a permanent member of staff as an instructor, might have to be thought of for each district or a group of districts.

5.12

TRAINING PROGRAMME I
LAY-OUT OF THE MODULES

Target Trainees: Local-level officials (representing the field officials at the lowest technical level concerned with work on rural road construction and maintenance) such as foreman, overseer, supervisor, junior engineer, technician, 'site engineer', 'civil engineer', 'assoc. civil engineer' etc. as they may be variously designated in the different member countries.

Background of the participants: degree/diploma/technical school certificate in civil engineering preferably with some experience.

Duration of the programme: 2 weeks

An outline of the syllabus for each module which contains a suitably proportioned but varying mix of lecture notes, videos, fields demonstrations of practices and lab. practicals of test procedures is given in Art. 5.13.

A. General series

- Module 1 Basic concepts in rural road engineering practice
- Module 2 Typical tools and equipment
- Module 3 Planning, Programming and Reporting at Work-site
(for quantity and cost control)
- Module 4 Soil investigations, soil properties, soil and materials testing
- Module 5 Introduction to bitumen technology
- Module 6 Introduction to concrete technology
- Module 7 Elementary survey and staking out.

B. Construction series

- Module 8 Earthwork including subgrade compaction
- Module 9 Earth and gravel roads (unpaved roads)

Module 10 Different pavement types: sub-base and base courses
(including stabilized soil techniques)

Note: Earth & Gravel roads are separately covered in module 9. Creteways (tracks) and concrete paving are covered in Module 6 Accordingly, the following will be covered in Module 10 relating to different pavement types:

- o water-bound macadam (stone or brick metal)
- o low-grade aggregates
- o soil-aggregate mixtures
- o mechanical (or granular) soil stabilization
- o soil-lime stabilization
- o soil-cement stabilization
- o soil-bitumen stabilization
- o brick pavement

Module 11 Bituminous surfacings

Module 12 Drainage and cross-drainage structures

Module 13** Quality control norms, related tests and their frequency.

** Indicates lower priority for Training
Programme I

C. Maintenance series

Module 14 Maintenance of a) earth and gravel roads
b) paved roads

Module 15 Maintenance of cross-drainage works, drains and slopes
(including environmental protection)

TRAINING PROGRAMME II LAY-OUT OF THE MODULES

Target trainees:

Quality control staff, materials engineer and lab.
technicians etc.

Background of the participants: degree/diploma in civil engineering

Duration of the programme: One week.

Module 1, 4, 5, 6, 10, 11 and 13 of Training Programme I would constitute the teaching aid for Training Programme II. No new module needs to be prepared.

TRAINING PROGRAMME III*
LAY-OUT OF THE MODULES

Target trainees:

Construction inspectors, materials inspectors and laboratory aides etc.

Background of the participants:

Diploma/degree holders in engineering or science graduates.

Duration of the programme: 4 days

D. Inspection series

- Module 15
- o Introduction to construction materials
 - o Classification of soils and aggregates
 - o Preparation for construction
 - o Layout grade and slope control
 - o Embankment inspection
 - o Inspecting finished subgrade
 - o Introduction to base course inspection
 - o Introduction to surface courses

* indicates lower priority and not to be taken up by ESCAP presently.

5.13

AN OUTLINE OF THE SYLLABUS
TRAINING PROGRAMME I

(a supplement to Art.5.12)

General Series

Module 1 BASIC CONCEPTS IN RURAL ROAD ENGINEERING
(V ONLY)

1.1 Introduction-definition of rural roads - importance and contribution of rural roads to rural and national economy -

1.2 basic concepts on load dispersion - interaction between road pavement, load, subgrade and water (drainage) - functions of an embankment and component layers of a pavement - mixed traffic - problem of bullock cart wheels - failure of roads their cause and cure - importance of drainage and compaction -

1.3 characteristics of rural roads - concept of stage construction - labour intensive and machine intensive technologies and factors governing their relative choice - employment potential in rural road development.

Module 2 TYPICAL TOOLS AND EQUIPMENT
(V ONLY)

General - type of tools and equipment - choice depending on degree of machanization - choice between labour - and machine - based technology - intermediate technology - common tools and implements-equipment for bituminous works done manually and done by mechanized methods for surface dressing, premix carpet and seal coat - tools and aids - their use in a) picking up or removing old pavement b) laying out c) cleaning the surface d) handling materials e) checking the accuracy of the work f) safety during construction.

L = Lectures

/Module 3

V = Video films

Module 3* PLANNING, PROGRAMMING AND REPORTING AT WORK-SITE
(FOR QUANTITY & COST CONTROL)
(L + V)

* tentatively included

need for planning - estimating quantities for each operation - planning by survey team after inspection, drawing-up plan and using productivity norms - calculation of mandays for each activity - planning by estimation based on experience - simple planning graphs - Time and Location Chart of ILO - their use - monthly reports - how to organize or programme labour force ? recruitment methods - systems of payment - muster roll - pay roll - store ledgers for tools, material and equipment - daily and weekly report forms - monthly report forms - checking monthly achievement after site inspection.

Module 4 SOIL INVESTIGATIONS, SOIL PROPERTIES, SOIL & MATERIALS TESTING

(L + V + D + P)

4.1 Pre-investigations - soil types in the ESCAP region - soil survey - borrow soil - its suitability - materials survey - investigations for possible use of soil stabilization techniques.

4.2 Soil properties - soil types - classification - simple field tests for identification - liquid limit test - plastic limit test - water content determination - grain size analysis (sieve analysis and hydrometer test) - moisture versus density relationship - OMC and max dry density - approximate determination of OMC in the field - tests for determining density in the field - CBR test - its limits and limitations - soaked CBR - unconfined compressive strength test.

4.3 Soil as a material of construction - for road pavement and embankment - types of locally available materials and aggregates - low grade aggregates - tests for evaluating their suitability for use indication of methods of processing them prior to their use etc.

Module 5* INTRODUCTION TO BITUMINOUS TECHNOLOGY
(L + V)

5.1 Bitumen-types of binder - emulsion - cut back - when to choose what - tack coat - priming coat - when do we use them ?

5.2 field laboratory for quality control in the field - reference to Module 11 - range of equipment normally required in a field laboratory - testing of aggregates - tests on viscosity - penetration - procedure for stripping test - bitumen content test using centrifuge extractor - tray test for control of rate of spread of binder.

* Note: Types of bituminous surfacings, their specifications and simplified construction guidelines are set out in Module 11

Module 6* INTRODUCTION TO CONCRETE TECHNOLOGY
(application to pavements, trackways and other structures)
(L + V)

6.1 What is concrete ? how to make good concrete ? procedure and steps involved - mixing, pouring, setting, hardening of concrete - tests to measure strength of concrete - testing procedure.

* Note: Only salient features of concrete technology and concrete pavements have been included as considered appropriate to the local-level staff. If more coverage is considered desirable by particular member countries, there is sufficient room left in the module for elaboration/inclusion at a subsequent stage.

6.2 Concrete pavements - pros and cons- when is their choice indicated ? specifications for concrete - mix design - standard specifications of concrete roads.

6.3 Use of concrete in creteways/trackways

6.4 Use of concrete in cross-drainage works - culverts - small bridges - pipe culverts - R.C. box culverts - for more details on cross drainage works - refer to Module 12.

Module 7 ELEMENTARY SURVEY AND STAKING OUT
(L + V)

Guiding principles of route selection - special considerations in mountainous and sand-dune areas-different types of survey - simple guidelines for staking out without the theodolite - use of hand level, boning rods, clinometers - crossings - grades - organization of gangs.

Construction series

Module 8 EARTHWORK INCLUDING SUBGRADE COMPACTION
(L + V)

8.1 Guideline for clearing and grubbing - bush clearing - tree and stump removal - boulder removal - lay-out grade and slope control.

8.2 Need for choice of proper soil type for embankment construction - side slopes - quantity of earthwork - cuts - slopes in cuts - earthwork operations - equipment different stages - earthwork spreading, watering, compaction in layers, checking whether moisture content is right for rolling - tools and equipment for compaction - plate vibrator - smooth wheeled roller - other types - animal and tractor drawn rollers - water bowsers - what is a subgrade ? Specifications for earthwork and subgrade compaction - quality control

and related tests for earthwork and subgrade compaction need for rigorous implementation of specification - frequency of testing in the field -

8.3 Use of camber board/template to check profile - inspection of embankment/finished subgrade.

Module 9 EARTH AND GRAVEL ROADS (UNPAVED ROADS)
(V ONLY)

9.1 Introduction to earth and gravel roads - how this module related to previous module 6 on 'earthwork including subgrade compaction' - requirements of earth roads - importance of drainage and compaction particularly in earth road - stages in construction of earth road - repeat relevant portions of module 6 - paramount need for periodic maintenance. Reference to Module 13.

9.2 What is a gravel road? properties of gravel - When to go in for a gravel road ? Specifications for gravel - how to construct a gravel road ? normal rate of wear - paramount need for periodic maintenance-reference to Module 13.

Module 10 DIFFERENT PAVEMENT TYPES: SUB-BASE AND BASE COURSES
(INCLUDING STABILIZED SOIL TECHNIQUES)
(L + V)

10.1 Introduction to basic principles regarding composition and thickness of pavements - load dispersion from wheel load on to the subgrade - reference to Module 1 - functions of component layers of pavement - evaluation of subgrade strength - subgrade getting saturated - CBR test - use of design charts - adhoc or recipe specs

10.2 Different pavement types - sub-based and bases - water bound macadam - stone and brick soling - soling stone with oversized metal - requirements of oversize metal for use in sub-based and base

courses - stone metal or brick ballast metal in base course - grading of stone metal and quantities required - for sub-base and base course - method of placing and consolidating the metal in the first and the second layer - renewal - low grade aggregates - physical requirements of low grade aggregates - soil aggregate mixtures - mechanical stabilization of soil - soil lime stabilization - degree of pulverization - strength criterion - soil cement stabilization - design considerations - concentration of cement - use of limestone aggregates with cement - lime and fly ash with soil - Mix design for cement - modified soil -

10.3 brick pavement - brick quality - subgrade preparation - brick soling.

10.4 Use of gravel and lime stone and other locally available materials in the different member countries.

10.5 Simplified construction guidelines for the different types of pavement described in 10.2, giving the related practices/procedures in a step-by-step sequence.

10.6 Quality control aspects and related tests.

10.7 Bituminous surface treatment - properties of bitumen - reference to Module 11 - deciding on the need for bituminous surfacing black topping.

Module 11 BITUMINOUS SURFACINGS (L + V)

11.1 bituminous binders - grades - choice of binder - reference to Module 5 - types of surface treatment - surface dressing - premix carpet - butiminous seal coat - related specifications on coarse aggregates and binder - can we do without bituminous surfacings for rural roads ?

11.2 various operations involved in construction - simplified construction guidelines relating to: a) one coat surface dressing; b) two coat surface dressing; c) premix carpet; d) seal coat with a brief mention of the related specifications already set out in 11.1 above.

11.3 quality control aspects and related tests on surface dressing work - avoiding overheating of bitumen - field laboratory for bituminous works - equipment needed - tray test for control of rate of spread of binder - binder content for paving mixtures.

Module 12 DRAINAGE AND CROSS-DRAINAGE STRUCTURES
(L + V)

C. Importance of drainage - road side drains - ditches - different types of cross-drainage structures - paved dips - rented causeways - submersible bridges - pipe culverts - cut-stone slab culverts - additional features of drainage in hilly terrain - low cost structures like diversion ditches, submersible culverts - use of empty bitumen drums - design features of culverts and small bridges - carriageway loadings - location of culverts - foundations - abutments, wings and piers - pipe culverts - reinforced box culverts - stone slab culverts - reinforced concrete slab culverts - timber bridges - special provision for spill over near culvert intake.

Module 13 QUALITY CONTROL NORMS FOR CONSTRUCTION RELATED TESTS, FREQUENCY OF TESTS ETC.
(L ONLY)

Listing out all important quality control tests relating to construction aspects, concerning different pavement types, bituminous surfacings, recommending number of tests required. Their frequency in terms of units of earthwork, metal work or surfacing work indicating

Module 14 MAINTENANCE OF A) EARTH & GRAVEL ROADS
B) PAVED ROADS

(V ONLY)

14.1 General - dust palliatives for earth roads - use of a drag - other measures - grading gravel roads - replenishment - dust palliative - grading working of a grader - wrong and right types of Camber - position of cutting blade of grader - how to patch an earth/gravel road regravelling a gravel road - standard method formats - or simplified guidelines giving standard procedures.

14.2 Maintenance of water bound macadam, brick pavements
and soil stabilized roads

14.3 maintenance of bituminous surfaces - various standard method formats for patching, pot hole, deformation, edge failures, cracks, resealing of surfaces - wet weather damage - ravelling - loss of cover aggregates - bleeding - corresponding standard method formats

14.4 maintenance of shoulders - arboriculture aspects.

Module 15 MAINTENANCE OF CROSS DRAINAGE WORKS, DRAINS AND SLOPES
(INCLUDING ENVIRONMENTAL ASPECTS)

(V ONLY)

15.1 General - cleaning of road - side drains - standard method formats for cleaning and repairing of cross-drains, pipes and small culverts.

15.2 Need to control erosion - and promote vegetation -

- silt and debris - surficial slips - treatment of embankment slopes
- hillsides - simple vegetative turfing - sodding - straw with cow dung - asphalt mulch technique - jute and coir netting for erosion control - slope treatment in sands lacking cohesion - use of gabions - catch water drains - restraining structures - geogrids etc.

15.3 Standard method formats for maintenance of side slopes/

bank protection

**ANNEX 3: LIST OF TRAINING MATERIAL
PRESENTATIONS**

ANNEX 3: List of Training Material Presentations

1. International Road Federation (IRF) Video Training Aids Series on Road Maintenance, demonstration tape (37 minutes).
2. IRF series video training aids on road maintenance Module 1: Common Maintenance Problems and Causes (21 minutes).
3. IRF series video training aids on road maintenance Module 9: Patching of Unpaved Roads (12 minutes).
4. IRF series video training aids on road maintenance Module 15: Cleaning of Lined Ditches, Culverts and Catch Basins.
5. ILO video training film on a labour-based road construction project in Thailand (about 40 minutes).
6. ILO video training module on planning of labour-based rural road construction (studio production).
7. Road Directorate of Guyana
Wrong and Right Way of Road Maintenance.
8. CRRI India, video training module on lime-stabilisation and water-bound macadam.
9. Philippines, Ministry of Public Works and Highways Audio-slides on an overview on labour-based methods on road construction and maintenance and on preconstruction activities.

**ANNEX 4: IRF VIDEO TRAINING AIDS
SERIES ON ROAD
MAINTENANCE**

ANNEX 4: IRF Video Training Aids Series on Road Maintenance

1. Common Maintenance Problems and Causes.
2. Traffic Control During Maintenance.
3. Pothole Repair in Asphalt Concrete Pavement.
4. Pothole Repair in Surface Treatment Pavement.
5. Crack Repair in Asphalt Pavement.
6. Repair of Depressions, Rutting and Corrugations.
7. Base and Sub-Base Repair.
8. Single and Multiple Surface Treatments.
9. Patching Unpaved Roads.
10. Smoothing and Reshaping of Earth and Gravel Roads.
11. Regravelling.
12. Reshaping Earth and Gravel Shoulders.
13. Replenishing Earth and Gravel Shoulders.
14. Mechanical Cleaning of Unlined Ditches.
15. Cleaning of Lined Ditches, Culverts and Catch Basins.
16. Cleaning and Clearing of Bridges.
17. Concrete Bridge Deck Repair.
18. Operator Daily Maintenance of Motorgraders.
19. Operator Daily Maintenance of Front-End Loaders.
20. Operator Daily Maintenance of Crawler Tractors.
21. Operator Daily Maintenance of Rollers.
22. Operator Daily Maintenance of Asphalt Distributors.
23. Operator Daily Maintenance of Dump Trucks.
24. Driver Daily Maintenance of Light Vehicles.

**ANNEX 5: CONTENTS OF ILO GUIDE TO
THE TRAINING OF SUPER-
VISORS FOR LABOUR-BASED
ROAD CONSTRUCTION AND
MAINTENANCE.**

13. STRUCTURES: LE-0 Module learning objectives and content
 LE-1 Nature, definition and types of structures
 LE-2 Culverts for streams and small rivers
 LE-3 Drifts
 LE-4 Causeways
 LE-5 Bridges
 LE-6 Module summary and check-point
14. GRAVELLING: LE-0 Module learning objectives and content
 LE-1 Nature and definition of gravelling
 LE-2 When to gravel and which methods to use
 LE-3 Selection of quarry
 LE-4 Organisational structure
 LE-5 Organisation of the work
 LE-6 Preparation of work plan
 LE-7 Administration and monitoring
 LE-8 Equipment, tools and materials
 LE-9 Module summary and check-point
15. MAINTENANCE: LE-0 Module learning objectives and content
 LE-1 Nature and definition of maintenance
 LE-2 Routine maintenance activities
 LE-3 Choice of methods for routine maintenance
 LE-4 Routine maintenance with equipment
 LE-5 Routine maintenance with labour only
 LE-6 Module summary and check-point

ADDITIONAL TO
EACH MODULE:

Field Instructions

Checklist for trainees and basis for field training.

ANNEX 6 : CONTENTS OF PHASE 1
TRAINING MODULES

ANNEX 6: Contents of Phase 1 Training Modules

1. Introduction to the Training Modules on Rural Road Construction and Maintenance
 - 1.1 Purpose of the training course.
 - 1.2 Course objectives and structure.
 - 1.3 Introduction to the concept of labour-based road construction and maintenance.
2. Planning
 - 2.1 Definition of planning and types of plans.
 - 2.2 Planning and/or evaluation of camp layout and resources for given labour force - accommodation, office space, storage space, provision of tools and other stores, water supply, sanitation, transport.
 - 2.3 Procedures for administering camp and construction sites - stores procedures, muster rolls, site records and work plans, tools inventories, monthly reports, payments, requisitions.
 - 2.4 Labour control procedures - recruitment, conditions of work, complaints and grievances.
 - 2.5 Preparation of Bills of Quantities for weekly and daily site construction programmes.
 - 2.6 Preparation of daily work plans for various construction operations.
3. Reporting and Control
 - 3.1 Definition, nature and flow of reports.
 - 3.2 Work Inspectionn - approval and disapproval.
 - 3.3 Records and reports - muster roll, daily record, monthly site report, stores-on-site record, work tickets, other reports.
4. Work Organisations
 - 4.1 Definition of Work Organisation.
 - 4.2 Construction sequence - operations and activities, gang size and balancing.
 - 4.3 Work incentives - daily paid work, piece work, task work.

4.4 Task work - setting tasks, task rates, adjusting tasks, inspecting work.

4.5 Inspections.

5. Tools and Equipment

5.1 Definition of efficient tools and equipment.

5.2 Effect of tools and equipment on labour productivity - characteristics of inefficient tools, results of tests with poor and good quality tools.

5.3 Characteristics of efficient tools and equipment - specifications, ILO Guide to Tools and Equipment for Labour-Based Road Construction.

5.4 Importance of correct tendering procedures.

5.5 Characteristics of main construction tools.

5.6 Maintenance and maintenance facilities.

6. Concrete Technology

6.1 Definition and characteristics of concrete.

6.2 Cement - properties and storage.

6.3 Aggregate.

6.4 The manufacture of concrete.

6.5 Placing, compacting and curing of concrete.

6.6 Manufacture of concrete culvert rings and other cross-drainage structures.

7. Survey and Setting Out

7.1 Selecting the road alignment - gradients, watershed road lines.

7.2 Instruments and aids for surveying and setting out.

7.3 Setting out of horizontal alignments.

7.4 Setting out of vertical alignments.

7.5 Setting out of cross-sections, including cuts and fills.

7.6 Hairpin bends.

7.7 Setting out of tasks.

8. Clearing

- 8.1 Definition and nature of clearing - emphasis on tools and equipment to improve traditional productivities.
- 8.2 Bush clearing.
- 8.3 Tree and stump removal.
- 8.4 Grubbing.
- 8.5 Boulder removal.

9. Earthwork

- 9.1 Definition and types of earthworks.
- 9.2 Measuring volumes.
- 9.3 Excavation.
- 9.4 Loading, hauling and unloading.
- 9.5 Fill - spreading, compaction (Module 10 in more detail), erosion protection.

10. Compaction

- 10.1 Definition of compaction - differentiations from consolidation.
- 10.2 Measurement of compaction.
- 10.3 Reasons for compaction - benefits of compacting - dis-benefits on non-compaction.
- 10.4 Fundamentals of compaction - effects of moisture content of the material, compactive effort, and thickness of layer.
- 10.5 Methods of compaction - types and choice of plant, transportability of plant.

11. Gravelling

- 11.1 Definition of and reasons for gravelling - selection of gravels methods of gravelling, tools and equipment, rate of wear and need for periodic maintenance.
- 11.2 Quarry selection and layout.
- 11.3 Organisation of gravelling - organisational structure, organisation of the workers, hauling, dumping and spreading.
- 11.4 Preparation of work plan.
- 11.5 Administration and monitoring.

12. Drainage

- 12.1 Definition and types of drains.
- 12.2 Soil conservation principles and road drainage.
- 12.3 Road surface drainage.
- 12.4 Side drains and lead-off drains.
- 12.5 Catchwater drains and scour checks.
- 12.6 Culverts.
- 12.7 Water-table drainage.

13. Construction of Small Drainage Structures

- 13.1 Definition and types of structures.
- 13.2 Culverts for stream and river crossings.
- 13.3 Drifts and fords.
- 13.4 Causeways and submersible bridges.

14. Maintenance Systems, Organisation and Management

- 14.1 Definition and nature of maintenance - routine, recurrent and periodic.
- 14.2 Cost-effectiveness of road maintenance.
- 14.3 Alternative methods of organising rural road maintenance.
- 14.4 Managing maintenance - assessment of requirements, allocation of resources, monitoring.

15. Maintenance of Unpaved Roads

- 15.1 Definition of types of maintenance.
- 15.2 Grading - types of grading.
- 15.3 Dragging and brushing.
- 15.4 Regravelling (Module 11 in more detail).
- 15.5 Filling and patching.
- 15.6 Dust prevention.

16. Maintenance of Paved Roads

16.1 Definition of types of maintenance - main defects.

16.2 Local sealing.

16.3 Crack sealing.

16.4 Patching.

16.5 Manual surface dressing.

17. Maintenance of Drainage Structures

17.1 Definition of the drainage system.

17.2 Side drains.

17.3 Drifts and fords.

17.4 Culverts.

17.5 Shoulders and slopes.

ANNEX 7: TASKS INVOLVED IN
DRAFTING THE TECHNICAL
CONTENT OF THE PHASE 1
MODULES

ANNEX 7: Tasks Involved in Drafting the Technical Content of the Phase 1 Modules

It will be necessary for a consultant to draft the technical content of the Phase 1 Modules as outlined in Annex 6. Each module will comprise two parts. The material to be used by the trainee and the instructions to the trainer on the presentation of the overall module. Compilation of the technical content of each module involves a number of operations.

1. Collation of existing material from the ILO Guide, World Bank Manual, TRRL, ESCAP, ECA and other sources.
2. Definition of supplementary information requirements and initiation of collection procedures from TRRL, ILO, CRRI and other sources.
3. Assembly of draft version of technical content for trainees.
4. Definition of detailed module content on the basis of information the trainee 'needs to know'.
5. Draft version of technical content for trainers.
6. Refine module content to fit a maximum of one-and-half days instruction per module¹.
7. Review, with communications expert, the guidelines for the trainees and trainers, and the scripts for the production of visual material.

This is estimated to take a minimum of three man-months consulting inputs. This effort will need to be spread over a five to six month period to allow for delays in collecting materials, and in communicating between the various organisations and individuals involved.

1 Modules are likely to be of unequal length, but will be designed to an average of one day over a working period of fifteen days.