

TRACECA - Project

Trade and Transport Sectors

Implementation of Pavement
Management Systems

Assistance to the ARD

Development of a
Routine Maintenance
Contract System
Project Completion
Report

Volume I

December 1997

KOCKS CONSULT GMBH
Consulting Engineers
Koblenz / Germany

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VOLUME II

1.	Standard Bidding Documents
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3.	General Specifications
4.	Inventory
5.	Bill of Quantities

Local Operator	EC Consultant
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Date of report : 6 December 1997

Reporting period : September 1997 to December 1997

Author of report: Frank Granberg/Werner P. Weiler

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EC Delegation			
	(name)	(signature)	(date)
TACIS Bureau (Task Manager)			
	(name)	(signature)	(date)

1. PROJECT SYNOPSIS

Project Title	:	Traceca Project - Implementation of Pavement Management Systems Addendum No. 1, Component 1, module B: Assistance to the Armenian Road Directorate (ARD), Development of a Routine Maintenance Contract System
Project Number	:	TELREG 9305
Country	:	Armenia

Wider project objectives	An improved road transport system..
Specific project objective[s]:	Basic principles for 'routine maintenance by contract' has been agreed on by ARD; The preparations for pilot project 'routine maintenance by contract' have been completed and accepted by the Armenian Road Directorate, Tacis and World Bank; Armenian Road Directorate agrees with the restructuring plan.
Planned outputs:	Pre-study for routine maintenance by contract; Detailed plan for pilot project "routine maintenance by contract"; Manuals, guidelines and reference texts for maintenance standards, contract forms, bills of quantities, bid evaluation, and quality assurance; Staff of ARD trained in maintenance standards, contract forms and QA.
Project activities	<ol style="list-style-type: none"> 1. Mobilisation of team, introductory visit at ARD by the Project Director and arrangement of logistics; 2. Management Development and Documentation <ol style="list-style-type: none"> a) Routine maintenance standards and service level b) Incorporate PMS in 'maintenance by contract' c) Drafting of tender documents for routine maintenance – Contract forms - Bill of Quantities - Bid evaluation model d) Organisation, management and resources e) Manuals and guidelines for internal routines f) Quality Assurance (QA) g) Legislation 3. Planning Pilot Study <ol style="list-style-type: none"> a) Selection and inventory of the pilot section b) Work programme for the pilot section c) Preliminary tender documents
Project starting date:	28 October 1996 (signing addendum) 9 September 1997 (actual start of project)
Project duration:	Services under part 1 until 7 December 1997

2. SUMMARY OF PROJECT PROGRESS SINCE THE START OF THE PROJECT

The project activities commenced with the arrival of the Project Director Mr. Werner P. Weiler in Yerevan on 09.09.1997. Logistics and resources were prepared for the arrival of the team on 19.09.1997. The team's work sessions in Armenia are shown in the table.

Name	Visit no.	Date, from to	
Project Director Mr. Werner P. Weiler	1	09.09.1997	19.09.1997
Project Manager Mr. Frank Granberg	1	20.09.1997	04.10.1997
	2	15.11.1997	06.12.1997
Road Maintenance Expert Mr. Carsten Griese	1	20.09.1997	25.10.1997
	2	10.11.1997	06.12.1997
PMS Specialist Mr. Carsten Griese	1	23.09.1997	06.12.1997
Maintenance Management Expert Mr. Sven Odén	1	15.11.1997	06.12.1997

Throughout the project there have been frequent creative discussions with Mr. P. Kartchikian, Deputy Director of ARD, Mr. N. Elarian, Head of PIU and the Project Co-ordinator, Mr. Hakob Petrosyan and other persons within PIU and the ARD, as well as some inspection tours. The second and third week of the first visit coincided with a visit by the World Bank evaluation mission. This offered an opportunity to discuss in a constructive way, the project with the representatives of the Bank, Mr. Anders Bonde and Robert Nooter. During the stay at the home office, Mr. Granberg, Odén and Griese collected and discussed supplementary base material for the study. The Inception Report, English version, was submitted 10 October 1997. The Russian version was presented 18 November. The Tacis Monitoring Team commented on the Report and initiated a revision of the Project Synopsis.

This Report consists of three parts, this summarising Section A, a part containing the details of the study, Section B and a set of Appendices with supporting data, Section C. Seven seminars were arranged to discuss important aspects of routine maintenance by contract and the pilot project. Recommendations and content of final report and of other findings were presented at a seminar - 26 November. Notes from the seminars are found in Appendix A. Based on the discussions at the seminars and discussions with the management of ARD and PIU, the programme for the pilot study was detailed and draft tender documents were produced. The pilot study programme is presented in Section B and draft Bidding Documents in Appendix B.

For the pilot project is chosen a 170-km section of the important main highway M2, from Yerevan to the Iran border, km 187+130 to km 356+990. Most of this section has been (or will shortly be) upgraded to a maintainable standard. Supplementary inventory work for the pilot section has been done and is reported as a part of Bidding Documents. Draft bidding documents - Standard Bidding Documents, General Specifications and Bill of Quantities - based on Highway Rehabilitation Project documents to the extent possible, are presented in the report, Appendix B. Updating of the inventory, supplementary revision of tender documents and tendering is proposed to take place from March to September 1998. The implementation is scheduled for October 1998 to October 1999. A detailed plan for tendering and implementation of the Pilot Project is in Section B.

There is an efficiency improvement potential in the introduction of routine maintenance by contract in combination with a strict client - producer concept, restructuring of the ARD organisation and management, and a comprehensive technical rationalisation of the production. The process of privatising the producer - the enterprises has begun. Initial support to management is included in the Pilot Project programme, and support to rationalisation is proposed as separate input, outside this project. The critical issue is financing of road maintenance. A stable financing is mandatory for a successful implementation of Routine Maintenance by Contract.

3. PROJECT PROGRESS IN FINAL PROJECT PERIOD

3.1. PROJECT PROGRESS REPORT

Project title: Traceca Project – Implementation of Pavement Management Systems, Assistance to the ARD		Project number: TELREG 9305		Country: Armenia		Page: 1	
Planning period: 10/1997 - 12/1997		Prepared on: 6/10/1997		EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany			
Project objectives: Assistance to the Armenian Road Directorate in the Development of a Routine Maintenance Contract System		EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany					
Main Activities		TIME FRAME					
		1997 Months					
No	ACTIVITIES IMPLEMENTED	PERSONNEL			EQUIPMENT AND MATERIAL		
		EC Consultant		Counterpart		OTHER	
		Planned	Utilised	Planned	Utilised	Planned	Utilised
1	Documentation Development and Summer Routine Maintenance Standards						
1.1	Review existing standards recommendation of standard definition and required service level		3.5 week		4.5 week		4.5 week
2	Winter Maintenance Standards						
2.1	Review existing standards recommendation of standard definition and required service level		3.5 week		4.5 week		4.5 week
3	Pavement Management System						
3.1	Adjustment of PMS to local condition and incorporate PMS in Mainten. by Contract		5 weeks		8 weeks		8 weeks
4	Tender Documents						
4.1	Contract forms for Routine Maintenance, incl Bill of Quantities		6 weeks		6 week		6 week
4.3	Bid evaluation model		1 week		1 week		1 week
5	Organisation, Management a. Resources						
5.1	Review present situation and proposal for the future organisation		1 week		1 week		1 week
5.3	Manuals and guidelines for internal routines		2 weeks		2 weeks		2 weeks
5.4	Quality Assurance (QA)		1 week		1 week		1 week
5.5	Legislation		1 week		4 weeks		4 weeks
6	Pilot Study Planning						
6.1	Selection and inventory of the pilot sections		2.5 week		4.5 week		4.5 week
6.2	Work Programme for the pilot section		2 weeks		2 week		2 week
6.3	Preliminary Tender Documents for the pilot section incl. Bill of Quantities		3 weeks		12 week		12 week
Form 1.6		31.5 weeks	31.5 weeks	40.5 weeks	40.5 weeks		40.5 weeks
TOTAL		31.5 weeks	31.5 weeks	40.5 weeks	40.5 weeks		40.5 weeks

3.2. RESOURCE UTILISATION REPORT

Project title: Traceca Project - Implementation of Pavement Management Systems, Assistance to the ARD		Project number: TELREG 9305	Country: Armenia	Page: 4	
Planning period: 9/1997 - 12/1997		Prepared on: 6/12/1997	EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany		
Project objectives: Assistance to the Armenian Road Directorate in the Development of a Routine Maintenance Contract System					
RESOURCES/INPUTS	TOTAL PLANNED (In Armenia +home office)	PERIOD PLANNED	PERIOD REALISED	TOTAL REALISED	AVAILABLE FOR REMAINDER
PERSONNEL					
Project Manager	6+1 weeks	4+1 weeks	3+2 weeks	5+2 weeks	
Maintenance Management Expert	3+2weeks	3+2weeks	3+2weeks	3+2weeks	
Road Maintenance Expert	11 weeks	8 weeks	7 +1 weeks	10 +1 weeks	
PMS Specialist	14 weeks	14 weeks	14 weeks	14 weeks	
Sub-total	37 weeks	37 weeks	37 weeks	37 weeks	0
EQUIPMENT AND MATERIAL					
Sub-total	NIL	NIL	NIL	NIL	
OTHER INPUTS					
Translator/Interpreter	NIL	NIL	NIL	NIL	
Driver	90 days 3 months	66 days 2 months			
Sub-total					
TOTAL	37 man-weeks	37 man-weeks	37 man-weeks	37 man-weeks	

3.3. OUTPUT PERFORMANCE REPORT

Project title: Traceca Project - Implementation of Pavement Management Systems, Assistance to the ARD		Project number: TELREG 9305	Country: Armenia	Page: 5
Prepared on: 6/12/1997		EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany		
Output results	Deviation original plan + or - %	Reason for deviation	Comments on constraints and assumptions	
1. Pre-study for routine maintenance by contract;	0			
2. Detailed plan for pilot project;	0			
3. Reports on maintenance standards, contract forms, bills of quantities, bid evaluation, and quality assurance;	0			
4. Staff of ARD trained in maintenance standards, and contract forms	0			

4. OVERALL REPORT ON THE TOTAL PROJECT

4.1. General

The project activities commenced with the arrival of the Project Director Mr. Werner P. Weiler in Yerevan on 09.09.1997. The project and its objectives were discussed with Mr. N. Elarian, Director of ARD, and key personnel. Logistics and resources were prepared for the arrival of the team on 19.09.1997. The team's work sessions in Armenia are shown in the table below.

Name	Visit no.	Date	
		From	To
Project Director Mr. Werner P. Weiler	1	09.09.1997	19.09.1997
Project Manager Mr. Frank Granberg	1 2	20.09.1997 15.11.1997	04.10.1997 06.12.1997
Road Maintenance Expert Mr. Carsten Griese	1 2	20.09.1997 10.11.1997	25.10.1997 06.12.1997
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Throughout the project there have been frequent discussions with the Mr. P. Kartchikian, Deputy Director of ARD, Mr. N. Elarian, Head of PIU and the Project Co-ordinator, Mr. Hakob Petrosyan and other persons within PIU and the ARD, as well as some inspection tours. The second and third week of the first visit coincided with a visit by the World Bank evaluation mission. This offered an opportunity to discuss the project in a constructive way with the representatives of the Bank, Mr. Anders Bonde and Robert Nooter. During the stay at the home office, Mr. Granberg, Odén and Griese collected, processed and discussed supplementary base material for the study.

The Inception Report, English version, was submitted 10 October 1997. The Russian version was presented 18 November. The Tacis Monitoring Team commented on the Inception Phase in their Monitoring Report No. 2, dated 3 November 1997. A revision has been made to the Project Synopsis, based on the remarks by the Monitoring Team.

This Project Completion Report consists of three Sections, this Section A, summarising data, reporting and recommendations, Section B with the bulk of reporting and descriptions, and Section C containing Appendices with notes from Seminars, Bidding Documents and inventory data for the chosen Pilot Section.

A number of seminars were arranged to discuss important aspects of routine maintenance by contract and the pilot project. The seminars were:

- SEMINAR 1 - Privatisation – commercialisation – client /supplier. (Held during first session 3. October).
- SEMINAR 2 - Pilot study area. (Held during first session 17. October).
- SEMINAR 3 - Goals and strategies for (routine) road maintenance – planning levels – 20 November.
- SEMINAR 4 - Maintenance standards – general technical standard. - 21 November.
- SEMINAR 5 - Tendering strategy. - 24 November.
- SEMINAR 6 - Bidding Documents and Procedure. - 26 November.

Recommendations, content of final report and other findings within the area of road maintenance of interest to ARD to consider was presented at a final Seminar on 26 November. Notes from the seminars are found in Appendix A.

Based on the discussions at the seminars and discussions with the management of ARD and PIU, the programme for the pilot study was detailed and draft tender documents were produced. The pilot study programme is found in Section B and the draft tender documents

in Volume II.

4.2. Routine Maintenance by Contract

4.2.1. Feasibility

Examples from other countries indicate that there are cost saving in the order of 15% or more to change from a traditional state run maintenance organisation to a client-supplier organisation where the contractors are competing in a market economy. The resulting road and transport standard is not lower than before. The system transition has forced the producers of maintenance services, both public and private to become more efficient through rationalisation of organisation, work methods and equipment.

4.2.2. Organisation

The key organisational change is the separation of client and supplier function. In Armenia suppliers, Enterprises are being separated from ARD. The Client role and place in the organisation has to be clearly defined.

4.2.3. Vision, goals and strategies

In the project a systematic approach to basic planning parameters has been presented and discussed. Clear and commonly known goals promotes not only productivity but also efficiency, which may be expressed as "to do the right things right".

4.2.4. Management

The field organisation, the enterprises are generally over- staffed, inefficient, and ill-equipped and over-staffed. The personnel are not well paid and there seems to be a lack of motivation. There is a great improvement potential in management and organisational development. The change from centralised bureaucracy to market economy and decentralisation requires change in attitudes and development of management.

The environmental aspect is also a neglected subject.

Work site safety for the workers could be better.

Quality should be given increased attention. A QA system could be a suitable tool.

4.2.5. Resources

Total staff within the state road organisation including enterprises, as a rule of thumb should not be more than around 400. Road maintenance should probably be organised in half a dozen regions.

Availability of plant and equipment is very much sub-standard. Most present equipment should preferably be abandoned as scrap. The number of items should be in the order of 300 pieces if compared with conditions in efficient Western road organisations. In a longer perspective the plant pool should be privatised.

Working methods including design and choice of material and equipment have a considerable improvement potential.

Rationalisation seems non-existing. The capacity, of for instance an asphalt plant, is in best case a half of the normal capacity.

4.2.6. Management information system

Efficient and modern management needs a number of tools to support planning decisions and follow-up. A PMS-system is introduced in Armenia and has been used for inventory for the Pilot Project. Additional road features have been added to the system for this special case, like, bridges, signs, drainage, etc. Other information systems are useful for bridge maintenance, BMS. A common road reference base should be used, like a Road Data Bank. It is important that all these systems fit into a common IT-strategy.

4.3. Pilot Project

4.3.1. Pilot area

Mr. Griese and Mr. Petrosyan studied a suitable area for a pilot project, and recommended for the purpose a 170 km section of the main highway M2, from Yerevan to the Iran border, km 187+130 to 356+990. This section has been upgraded to a maintainable standard and is part of the most important highways in the country. The choice of pilot area was proposed at a seminar in the 17th of October and was the base for a road inventory. During the seminars in November the criteria for deciding the size of a maintenance area was discussed. The inventory is completed and attached to the Bill of Quantities, but has to be updated before the maintenance of the pilot area is let to tender. All but 44 km of the road will be in good condition before the start of the Pilot Project. The area is small in an international comparison. Special conditions, like insufficient means of communication and control and follow-up problems, justify the selection. The option to include also surrounding republican roads has been discussed, but it is still an open question. Final decision should be reached early next year.

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4.3.2. Project synopsis for the pilot study project

Wider project objectives	An improved road transport system..
Specific project objective[s]:	Learning for routine maintenance by contract system with a pilot project. (Phase 2 and 3)
Planned outputs:	<ol style="list-style-type: none"> 1 Tender documents and procedure for Pilot Project "Routine Maintenance by Contract" in the selected Pilot Area; 2 Implementation and Follow-up of Pilot Project
Project activities	<ol style="list-style-type: none"> 1 Mobilisation of team, <ol style="list-style-type: none"> 1.1 Introductory visit at ARD, arrangement of logistics; 2 Management Development <ol style="list-style-type: none"> 2.1 Review of Goals and Strategies 2.2 Review of Routine Maintenance Standards 2.3 Introduction to management training 3 Bidding Documents for Routine Maintenance <ol style="list-style-type: none"> 3.1 Updating of inventory of the pilot section 3.2 Standard Bidding Documents 3.3 General Specifications 3.4 Bill of Quantities 3.5 Quality Assurance (QA) 4 Bidding procedure <ol style="list-style-type: none"> 4.1 Bid evaluation 4.2 Approval of Work Programme for the pilot project 4.3 Award of Contract 5 Pilot Study <ol style="list-style-type: none"> 5.1 Monitoring of road condition 5.2 Follow-up of costs and resources 6 Final Report
Project starting date:	March 1998 (Suggested)
Project duration:	20 months (October 1999)

4.4. Project Completion Report

Project title: Traceca Project - Implementation of Pavement Management Systems, Assistance to the ARD		Project number: TELREG 9305	Country: Armenia	Page: 11
Planning period: 9/1997 - 12/1997		Prepared on: 6/12/1997	EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany	
REPORTING PERIOD	MAIN ACTIVITIES UNDERTAKEN	EC CONSULTANT	INPUTS UTILISED	
9/97 – 12/97	1. Mobilisation of team, 2. Management Development and Documentation 3. Pilot Study Planning	- 7 months 2 months	MATERIALS AND EQUIPMENT Nil	OTHER 5 flights
TOTAL		9 months		

4.5. Output Performance Summary

Project title: Traceca Project - Implementation of Pavement Management Systems, Assistance to the ARD		Project number: TELREG 9305	Country: Armenia	Page: 12
Prepared on: 6/12/1997		EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany		
Output results	Deviation original plan + or - %	Reason for deviation	Comments on constraints and assumptions	
1. Pre-study for routine maintenance by contract;	0			
2. Detailed plan for pilot project;	0			
3. Reports on maintenance standards, contract forms, bills of quantities, bid evaluation, and quality assurance;	0			
4. Staff of ARD trained in maintenance standards, and contract forms	0			

5. LESSONS LEARNT AND RECOMMENDATIONS

5.1. Risks

The risks for the continued project and the full-scale introduction of routine maintenance by contract are financing, the development of organisation of the road sector, development of the contractors competence and technical rationalisation, and unforeseeable social consequences.

5.2. Management Development

5.2.1. Management support

In the development of ARD and of the enterprises it is important that efficient management approaches are employed. The Consultant recommends that a Management Consultant is engaged to support both ARD and the enterprises in their institutional and organisational development. The support should last over a period of several years, starting with a introductory seminar lasting one week to show the usefulness of management training and to analyse the situation and the needs. The participation from the management of enterprises could be voluntary. After the first visit the Management Consultant should return with regular intervals to do training and check up on the development of the organisation. An introductory one-week programme is included in the Pilot Project, but financing has to be found for continued management support.

The introductory programme is a pilot programme to

- Introduce key concepts and techniques in People and Business Management
- Determine level of future support to ARD and Enterprises

Target group is ARD (incl. PIU) Managers and invited/selected Heads of Enterprises.

5.3. Rationalisation

The enterprises are the main target group for rationalisation training. There is a very great potential to improve productivity by means of more efficient work methods and equipment. The consultant recommends a programme for training of trainers for Rationalisation Engineers. A Rationalisation Engineer should train two or three experienced engineers (5 years experience) from a country with a modern and rational maintenance set-up. The objective of the training is to teach methods for measuring productivity and analysing work methods, and enable them to make a programme for training new engineers and to implement the training programme. Emphasis should be on the road sector.

5.3.1. Introduction to rationalisation training

The objective is to train a limited number of engineers in the concept and techniques of rationalisation in order to enable them to train other engineers. The target is the new enterprises, which have a low productivity and efficiency, partly as an inheritance from the earlier political system.

A first training input should last for a week and a suitable schedule could be as follows.

Day	Subject	Time, hrs
1	Introduction: "Why rationalisation"	2
	Capacity – fundamentals	6
2	Capacity – simple time analysis, video	3
	Volume, transport and digability, basic elements.	5
3	Processing – simple time study	3
	Work methods	5
4	Calculating capacity	8
5	Cost calculations	5
	Summary and conclusions	3

Experience from this introductory session will form the base for planning of following sessions and activities. Practical studies in the field should follow with time studies, calculation of capacity and costs, comparison of different study methods, calculations for chained production processes. The estimated time for these following sessions is in the order of two weeks. Estimated costs: approximately 15 000 ECU.

5.3.2. A practical demonstration of efficient work methods

Another more direct and practical way to rationalise and illustrate the potential of rationalisation is to provide ARD, either directly or through an enterprise, with a piece of equipment with instructors and support over a period of time. The equipment, which has been discussed between ARD and the Consultant, is a Swedish make truck attachment for mending potholes and similar damages to the road. Depending on whether or not the equipment can be fitted on an existing truck the costs are very roughly estimated to be in the order of 150 000 and 300 000 ECU, respectively.

5.4. Traffic Safety

The traffic safety situation and traffic behaviour on roads and streets are frightening experiences. Unfortunately might better roads lead to higher speeds in traffic and worsening of the consequences of traffic accidents. Hopefully there are already projects tackling the traffic safety problem.

5.5. Environmental aspects

Presently the practical result of any programme for protecting the environment seem not to be visible.

5.6. Other Road Authorities

Although city streets and other roads than Highways and Republican roads are not the responsibility of ARD, it is obvious that there is a need both for rehabilitation and for maintenance of these roads. Financing is also a problem for these roads, as well as the organisation of maintenance. The Consultant recommends that this problem is looked further into. A very decentralised and transparent approach is recommended for local roads.

6. ORGANISATION OF THE STUDY

The Consultants input was organised in two visits. Between the visits, the staff assigned to the Project carried out specific tasks, and the Consultant prepared material for the second visit at his home office.

The project activities commenced with the arrival of the Project Director Mr. Werner P. Weiler in Yerevan on 09.09.1997. Logistics and resources were prepared for the arrival of the team on 19.09.1997. The team's work sessions in Armenia are shown in the table.

Name	Visit no.	Date, from to	
Project Director Mr. Werner P. Weiler	1	09.09.1997	19.09.1997
Project Manager Mr. Frank Granberg	1	20.09.1997	04.10.1997
	2	15.11.1997	06.12.1997
Road Maintenance Expert Mr. Carsten Griese	1	20.09.1997	25.10.1997
	2	10.11.1997	06.12.1997
PMS Specialist Mr. Carsten Griese	1	23.09.1997	06.12.1997
Maintenance Management Expert Mr. Sven Odén	1	15.11.1997	06.12.1997

Throughout the project there have been frequent creative discussions with the Mr. P. Kartchikian, Deputy Director of ARD, Mr. N. Elarian, Head of PIU and the Project Co-ordinator, Mr. Hakob Petrosyan and other persons within PIU and the ARD, as well as some inspection tours. The second and third week of the first visit coincided with a visit by the World Bank evaluation mission. This offered an opportunity to discuss in a constructive way, the project with the representatives of the Bank, Mr. Anders Bonde and Robert Nooter. During the stay at the home office, Mr. Granberg, Odén and Griese collected, processed and discussed supplementary base material for the study. More work than originally planned, was done at the home office, as the deadline of the project was 7 December and not 12 December.

Seven seminars were arranged to discuss important aspects of routine maintenance by contract and the pilot project.

6.1 Reporting

The Inception Report, English version, was submitted 10 October 1997. The Russian version was presented 18 November. The Tacis Monitoring Team commented on the Inception Phase in their Monitoring Report No. 2, dated 3 November 1997. The Project Synopsis is revised in line with the remarks by the Monitoring Team.

6.2 Acknowledgements

The discussions in seminars and else with the staff of ARD and PIU have been very fruitful and constructive. The ARD and PIU staff have proved to be highly professional and competent. The engagement and interest shown by Mr. P. Kartchikian, First Deputy Chairman of ARD, and Mr. N. Elarian, Head of PIU has been essential to the result of the project.

7. APPROACH AND METHODOLOGY

The project consists of a pre-study for Routine Maintenance by Contract, and a detailed plan for a pilot project. The following activities are included and carried out in close co-operation with the ARD:

1. Summer Routine Maintenance Standards
 - 1.1 Review existing standards
 - 1.2 Recommendation of standard definition
 - 1.3 Recommendation of required service level
2. Winter Maintenance Standards
 - 2.1 Review existing standards
 - 2.2 Recommendation of standard definition
 - 2.3 Recommendation of required service level
3. Pavement Management System
 - 3.1 Adjustment of PMS to local condition
 - 3.2 Incorporate PMS in Maintenance by Contract
4. Tender Documents
 - 4.1 Contract forms for Routine Maintenance
 - 4.2 Standard Bill of Quantities
 - 4.3 Bid evaluation model
5. Organisation, Management and Resources
 - 5.1 Review present situation
 - 5.2 Proposal for the future organisation
 - 5.2 Manuals and guidelines for internal routines
 - 5.3 Quality Assurance (QA)
 - 5.4 Legislation
 - 5.5 Pilot Study Planning
6. Selection of the pilot sections
 - 6.1 Inventory of the pilot section
 - 6.2 Work Programme for the pilot section
 - 6.3 Bill of Quantity for the pilot section
 - 6.4 Preliminary Tender Documents for the pilot section

The project is carried out in co-operation between the consultant and an RMCS Committee, which is composed of members of the PIU and based in Armenia. The ARD assigned a local Project Manager, Mr. Hakob Petrossyan, to assist and advice the consultant generally, and to lead the implementation and local components of the work. In addition, the ARD arranged required meetings with various specialists for occasional briefings, opinions and reviews of output. The main instrument for exchange of information and opinions were a number of seminars arranged for different key subjects. A list of meetings, people met and other events is attached as Appendix C.

7.1 Seminars

A number of seminars were arranged to discuss important aspects of routine maintenance by contract and the pilot project. The seminars were:

- 0 Privatisation – commercialisation – client /supplier. (Held during first session 3. October).
- 1 Pilot study area. (Held during first session 17. October).
- 2 Goals and strategies for (routine) road maintenance – planning levels – 20 November.
- 3 Maintenance standards – general technical standard. - 21 November.
- 4 Tendering strategy. - 24 November.
- 5 Bidding Documents and Procedure - 26 November.
- 6 Presentation of recommendations and content of final report and of other findings within the area of road maintenance which could be of interest to ARD to consider. - 26 November.

Notes from the seminars are found in Appendix A.

Based on the discussions at the seminars and discussions with the management of ARD and PIU, the programme for the pilot study was detailed and draft tender documents were produced. The pilot study programme is found in Chapter 5 of this Section and the draft tender documents in appendix B.

8. ROUTINE MAINTENANCE BY CONTRACT

8.1 Definitions

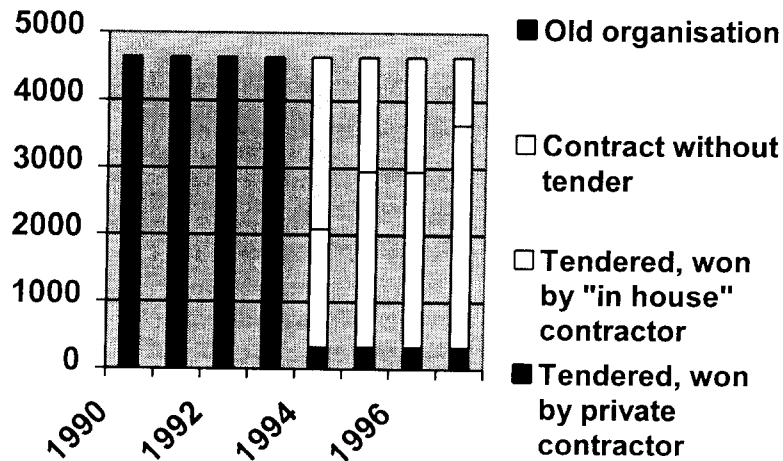
The following definitions are used by ARD and in the project.

1. Routine Maintenance covers the road maintenance activities, which are required more or less continuously on any road. These activities are such as removal of debris and other obstacles to traffic, repairing of pot-holes, drainage clearing, grass cutting, bush clearing, road sign cleaning and repair, repairing of ruts, grading on gravel roads, patching, repairing edges and sealing cracks on paved roads. Sub-groups of activities in routine maintenance are:
 - Urgent repairs and works which are required to keep the road open to traffic in a relative safe way,
 - Recurrent maintenance of paved roads, which means repair activities performed at intervals during the year to decelerate the deterioration of the paved surface,
 - Recurrent maintenance of gravel roads, which includes grading and pothole repair,
 - Winter maintenance, which includes snow and ice removal, gritting and salting.
 2. Periodic Maintenance covers maintenance required at intervals of several years, like maintenance of side drains and other drainage facilities, regravelling of gravel roads and gravel shoulders on paved roads, resealing and resurfacing of paved roads, and renewal of road signs and markings
- Bridge maintenance is an important aspect of road maintenance, which can be fitted in with the above definitions.

8.2 General Feasibility of Routine Maintenance by contract

The experience gained in countries, which have introduced maintenance by contract is that costs gradually have decreased by at least 15%. The example (from Sweden) shows how the volume of work let to tender gradually has been increased to about 80% of the road network in the studied area. The

area comprises a total of 4640 kilometres. A private contractor won the contract for 330 kilometres, while the state enterprise won the contracts for 3310 kilometres. The number of trucks engaged to do winter maintenance, when required, decreased from 140 to 119. This number included 23 trucks owned by the enterprises and 96 trucks contracted for



winter maintenance tasks. The number of workers decreased from 118 to 62 and the number of supervisors and administrative staff from 30 to 16.

There were six maintenance areas/contracts with average 770 kilometres of public roads to maintain. In 1997 there were

- In winter, 1 truck for every 40 kilometres
- In summer, 1 truck for every 200 kilometres
- One operator/worker for every 75 kilometres
- One management staff for every 300 kilometres

Maintenance costs decreased with some 15% with unchanged or higher standard. The competition triggered rationalisation, not only in the numbers of staff and equipment but also with respect to working methods. Armenia has a considerably higher potential for cost reduction and increased productivity.

8.3 Organisation

A prerequisite for a functioning Routine Maintenance by Contract system is that the role as Client and the Supplier role are separated and well defined. The present organisation of ARD is a step in that direction as the enterprises are being separated from the ARD. Still it is necessary to define the role as Client clearly and find a suitable organisation. The figure illustrates the principal situation. There is also indicated the existence of a Road Fund to illustrate the necessity of sufficient and reliable finance for road maintenance activities.

8.4 Vision

It is important to spend sufficient time and efforts on clarifying the ultimate objectives of the organisation and the projects. As a base for the discussion and analysis could serve a vision of the future based on facts, intuition and imagination. Among factors considered could be the culture and characteristics of Armenia and comparisons with countries, which are more experienced in the ongoing evolution of the public sector, especially the road sector.

When the present situation is compared with an ambitious vision of a distant future one might find that some realistic limitations has to be applied to the vision to make it sufficiently ambitious and focused on the roads. This could result in a vision for ARD, and serve as a base for

objectives for the development of ARD. Based on the tentative vision and an evaluation of the present situation in Armenia, including a comparison of organisation and resources between Armenia and European countries, a detailed vision for a 5 to 10 year period could serve as a base for a new strategy.

The following is an example, which can serve as a base for the continued discussions within ARD.

- The road network in Armenia is available for road users all the year round.
- Normal speed, 70 - 90 km/h can be used except during extreme weather conditions. During the thaw-period, however, there could be load restrictions for heavy traffic and reduced speed for other vehicles.
- Motorists and people living along the roads are satisfied with the services provided by ARD and its contractors.
- All main highways are rehabilitated and in a decent, maintainable standard. Even road signs and markings and guardrails are up to standard. Debris on the road, fallen rocks etc. is instantly cleared of the road.
- Both Highways and Republican roads receive proper maintenance.
- Rest areas are kept nice and clean.
- Drainage, side drains and culverts are up to standard and well maintained.
- Bridges have been rehabilitated and continuously well maintained.
- The ARD is a client organisation with competence to buy routine maintenance. ARD uses a QA-system with well-defined routines for the management of maintenance contracts.
- There are established standards and routines for
- tender documents,
- evaluation of the bids and choose the best contractor and
- follow up economy and production
- There are several competent contractors with efficient organisations for routine maintenance. They have QA-systems that ensure that the road users get a road standard according to the tender documents.
- The standards for routine maintenance are described in measurable terms, possible to control
- Alternative forms of contract for routine maintenance are used in order to take advantage of the market situation and to give the contractors an incentive for development and efficiency.
- Since establishment of a road fund, which functions well, there are no major financial problems for the road sector.
- Management within ARD is applying modern and efficient personnel management approaches, which resulted that the turnover of personnel is among the lowest in the country. There are no problems to recruit new and well-qualified staff. Modern management tools and information systems are used efficiently.
- ARD has inspired contractors to rationalise their organisation and work methods with good economic return, both for themselves and for ARD (and transport in Armenia).

8.5 Goals and Strategies for Road Maintenance

This subject was discussed in Seminar 3, and resulted in an attempt to formulate guidelines for the development of ARD. The general political goals and objectives set by Parliament give the framework for the road sector, but gives little help in the situation when competing wishes and ambitions have to be prioritised and fitted into a narrow economic frame. The objectives might be restructured and grouped as follows.

- Maintain the capital invested in roads
- Improve transport economy
- Improve traffic safety
- Establish an environmentally friendly transport system
- Integrate with other transport systems
- Satisfy the needs of people and the national economy
- Develop a sustainable financing system for road maintenance

The main objective for maintenance of roads is to preserve the economic and technical value of the very large capital represented by the road network. Negligence of maintenance will result in rapidly accelerating deterioration of the investment, which in term affects the other goals negatively. One way to give a structure to the discussion about priorities and preferences of road maintenance is to study to what extent a certain maintenance activity has effect on different objectives. The goals on which maintenance activities have the greatest impact in Armenia were found to be:

- To promote the interest of road users
- To promote traffic safety
- To preserve road capital
- To preserve the environment

The most important goals to make it possible to carry out maintenance activities were:

- To introduce market economy in the road sector
- To arrange stable financing for roads
- To establish modern planning system
- To introduce and implement a priority system for road construction, improvement, rehabilitation and maintenance

The table below shows the summary of the discussion in the seminar

Maintenance Activities, Effects on Goals and Importance of Goals

Maintenance Activity	Effects of maintenance activities on following goals			Importance of following goals for efficient road maintenance			
	Preservation of capital	Promote interests of road users	Traffic safety	Market economy	Stable financing	Modern planning system	Priority system
Winter maintenance							
Snow clearing	small	Large	large	large	medium	medium	medium
Salting	small	Large	large	large	large	small	small
Paved roads							
Routine	large	Small	large	large	large	small/ medium	small/ medium
Periodic	large	Large	large	large	medium	medium	medium
Gravel shoulder	small	Large	medium	small	large	small	small
Gravel roadway	large	Large	large	large	large	large	large
Drainage	large	Medium	medium	medium	medium	medium	medium
Bridges	large	Large	medium	large	large	large	large
Road signs and markings	small	Large	medium	small	small	small	small
Grass cutting & bush clearing	small	Large	medium	small	small	small	small

The table might form the basis for discussion of priorities in different financial situations, both in the advance planning for a new year and during a year if and when unforeseen events makes it necessary to slim the running budget. The content and the evaluation of the table is also a matter for discussions as different experts probably have different views. Depending on the degree of importance of the different political objectives, priorities can easier be made between activities, which have a great effect on transport costs, and those, which promote traffic safety. If all goal aspects have equal value, then activities, which have a significant positive effect on several of them, should be given higher priority than others should. Winter maintenance and maintenance of paved roads is falling into this category although salting is undesirable from an environmental point of view.

In the present situation it seems most important to preserve the capital vested in roads by means of a comprehensive pavement rehabilitation programme to put at least the main roads in a maintainable condition, which is a requirement for meaningful routine maintenance. Such a programme will result in reduced needs and costs for routine maintenance like pothole mending and crackfilling. Meanwhile vehicle operating cost for traffic will gain. This is an important and profitable preventive action. In general maintenance should if possible give priority to preventive activities in pavement maintenance, bridge maintenance, winter maintenance and drainage maintenance in order to minimise maintenance cost over a longer period of time. When a reasonable standard is reached for pavements, bridges and drainage, etc. emphasis could be move more towards first traffic safety and second also environmental aspects.

8.6 Planning levels

It might be convenient to design the maintenance plan for three different funding levels. The first one, the **Goal Level**, represents the funds, which correspond to the full policy for road maintenance, as indicated by the Government. The second level, the **Budget Level**, corresponds to the most likely funding level for the coming budget period. A third level. **Cut Down Level**, describes the strategy to be chosen if the funding level will be less than expected. In this manner there will be preparedness for changes rather than a strict and rigid plan.

The **Goal Level** is the funding level which incorporates a volume of maintenance operations which is optimal in relation to Government's policy. This is the level when the socio-economic effects breaks even with the financial costs of the maintenance programme. The goal level includes funds required to gradually eliminate the backlog from previous years.

The **Budget Level** is based on the current level of funding or the best guess of the level for the

coming year. Budget Level is lower than the Goal Level and the funds are inadequate to cover all economically justified maintenance needs.

Priority is to be given to operations according to the strategy chosen with help of the structure illustrated in the table above.

The Cut Down Level is useful for both analysis of the flexibility in the maintenance organisation and to create preparedness if the funds become less than anticipated. A plan at this level should result in effective operations although at a lower level than originally planned.

The Normalised Minimum Level is in this case an in-between level, which does not include any compensation for the backlog.

During discussion it was said that the present ARD budget for routine maintenance only covers 15-20% of the goal level. The introduction of a Road Fund will however most likely lead to a more realistic financial situation for ARD. Table 3.1 is a principal example how the present situation can be dealt with. In reality there has to be a considerable amount of calculations, discussions and considerations to arrive at an acceptable solution.

Planning levels

Funding Level	Additional volume of these activities	Less of these activities
Goal Level 1)		
Normalised Minimum Level 2)	Pavement maintenance, routine and periodic.	Periodic pavement
Cut Down Level -	Maintenance emergency repair	

1) This level was too far away from the actual situation to be discussed

For a new and better system of financing the same approach can be used to illustrate the effect of alternative levels of finance.

The value of the present state road network in Armenia may very roughly be estimated at something like 1000 million USD. To compensate for depreciation it can be advocated that a certain percentage of this value should be used for maintenance and improvement of the network each year. The road network seems sufficiently dense in an international comparison, and there does not seem to be any missing links, although some are of inadequate standard. Therefore much emphasis has to be put on maintenance and improvement of the existing network.

International comparisons on how much is spent on maintenance shows that if the roads are kept in a good condition through preventive actions by periodic maintenance, cost for routine maintenance will be very moderate. This leads to the conclusion that it is very important, not only for traffic, but also for total costs of road maintenance to as soon as possible upgrade the roads in a good maintainable standard in a rehabilitation programme.

8.7 Management and Personnel

Presently there are some 2000 to 3000 working in the road sector with ARD and the Enterprises. They seem to be far too many for an efficient production. Comparisons with countries with comparably rational structure of the road sector indicate that the number should be much lower. In the example in the beginning of this chapter there was a field organisation of only 78 people running the maintenance of a network of the same length as Highways and Republican roads in Armenia. They were well outfitted with modern and efficient equipment and they might also use sub contractors for certain work, like bush clearing and grass cutting. In a vision for Armenian road sector the total number of people employed or used through contractors by ARD could be in the order of a couple of hundred, or at least not more than 500. This of course requires that there is modern and efficient equipment. The Enterprises staffing is the main problem. Both management and clerical staff and workers have to be drastically reduced in number to promote efficiency and competitiveness. Slimming seems not to be the problem in the remaining ARD organisation. There might instead be a need to recruit certain competence and capacity.

In this development there is a need for improvement of management, both personnel management and technical management utilising various technical information systems.

Personnel management deals with how to organise work, how to motivate staff, how to be efficient by means of delegation of powers and responsibilities.

8.8 Equipment

As said in the Inception Report most of the present plant and equipment at the disposal of the enterprises is useless. A comprehensive programme for equipping the new, slimmed enterprises is a prerequisite for an efficient production.

8.9 Management information system – PMS

A management information system is a necessary feature of resource allocation and distribution. The management information system ensures, over time, a consistent and well-justified level of funding for maintenance and rehabilitation.

The RoSy pavement management system (PMS), which was installed by the Consultant under the previous project, is a maintenance management process aimed at systematically and objectively determining pavement quality and programming maintenance action in response to observed conditions, budgetary constraints and economic optimisation (reduction of user costs, optimising investment costs).

The function of RoSy PMS is to improve the efficiency of decision making, expand the scope, provide feedback on the consequences of decisions and facilitate the co-ordination of activities within the agency. The PMS is a tool which provides assistance to the maintenance engineer for maintenance programming, implementation and monitoring.

The major objectives of the pavement management system are the following:

- Provide the economic and managerial framework for deciding the optimal level of maintenance funding and the optimum level of pavement condition.
- Provide annual work programmes and determine budgets
- Schedule and perform the work
- Evaluate the consequences of delaying or postponing maintenance on future budget needs and the future deterioration of pavement condition.

RoSy pavement management system consists of the modules RoSy BASE and RoSy PLAN.

- RoSy BASE is the capacious and flexible road database
- RoSy PLAN is the optimisation module for calculation of optimum maintenance solutions as well as consequence analyses.

In outline, the pavement management system is be capable of assessing the physical and operating condition of the current road network with the accuracy and detail desired by the road administration. By using estimates of traffic demands, the pavement management system provide forecasts about future investment requirements.

The pavement management system in the development of a routine maintenance context will be used for the information of the contractor. Maintenance requires information about the network, physical characteristic of its links, inventory data and pavement condition. It is therefore necessary to work with facts and therefore to have a sufficiently reliable and thorough description of the condition of the roads.

8.10 Adjustment of pavement management system (PMS)

The principal objective of the adjustment of the pavement management system is to validate the pavement performance laws, which describe changes to the type of road structure and external parameters (traffic, time, climate, work quality). The adjustment is absolutely essential in order to avoid the situation whereby, for example, the model predicts that a road will deteriorate very quickly but in reality it performs very well.

The creation, adjustment and adaptation of deterioration models and possible maintenance methods and products in RoSy PMS to local condition is rather flexible.

The proposed adaptation of the pavement management system are presented in Appendix B.

8.11 Legal aspects

The legislation required for privatisation of the road sector and contracting out road maintenance exists.

9. PILOT PROJECT

9.1 General

The transformation of the present organisation towards an ambitious vision of the future can hardly be done in one step – it probably requires many small and tedious steps in a more or less continuous process of change. The vision will very likely change on the way through this process. A strategy and a plan for development has to be worked out and adopted in the ARD, and known and accepted by all involved. Four steps were described in the Terms of Reference. The first two steps, as described below, were supposed to be included in phase 2 and phase 3 of this project.

Step 1. Separate the “client” and “supplier” functions of road maintenance (including both periodic and routine maintenance). Establish a buyer-seller relation within the ARD but keep skills for work management and supervision in the client’s organisation. Buy routine maintenance as well specified activities on a short-term basis like periodic maintenance. This means that the major risks remains with the client. There is an ARD-owned plant pool, which could remain temporarily during this intermediate stage.

Step 2. Increase the contents and extend the time of the contracts. Contractors to do all supervision. The client should reduce resources for work management and supervision. The suppliers should be fully responsible for plant and equipment. Tendering procedures are used and private contractors could be competing with the ARD “suppliers” in a pilot region.

The actual situation today is that the client and suppliers are separated. The previous “Enterprises” within ARD are now independent legal entities and there is a program to reduce the number and to privatise all but 16 enterprises. Before those changes there were 7 construction enterprises and 37 maintenance enterprises. This means that step 1 is achieved but the skills for work management has been and will remain mainly with the suppliers.

9.2 Choice of pilot area

The choice of pilot area was proposed at a seminar in the 17th of October and this proposal was the base for a road inventory. During the seminars in November the choice of pilot area and the criteria for deciding the size of a maintenance area was discussed. Experiences from Sweden were presented. Parameters that affects the size of maintenance areas in Sweden are:

- Amount of services to include in the area
- Maintenance period (number of years)
- Average traffic volume
- Estimated cost of the contract
- Geographic area
- Climate conditions.
- Number of competing contractors
- Available equipment and management tools

In Sweden the size of maintenance areas varies from 170 km to 1260 km. An average size is 600 – 700 km. The extreme values have been used to test the market, to see if a big area gives lower prices and to see if a small area gives more competitors. The experience so far is that a too big area limits the number of competitors without affecting the price. But a small area has not increased the number of competitors to an extent that motivates the extra administration of many small areas.

The number of services has increased during the development of routine maintenance by contract. In the first contracts, service levels only were used to define the work, but later on preventive work concerning ditch clearance and sealing have been added.

In Armenia the present condition of the roads has to be considered as well. Repair of cracks and potholes dominates the total cost of routine maintenance to an extent that limits the size of the area. As this repair work is hard to calculate and preferably will be bought as separate activities the idea to by routine maintenance mainly based on service levels is likely to fail. Therefore, in the choice of a pilot area, one criteria has been to find a network with a maintainable standard in order to reduce the percentage of the total cost used for patching.

The chosen area in the southern part of Armenia will comprise 126 km well maintained road when the contract period starts in October 1998. Only 44 km will be in a poor condition. Although the total length of the roads is much less than in Sweden, it is a step in the right direction. When the republican roads have been upgraded it will be possible to include them as well and the total length will then be some 320 km. The lack of tools for communication, monitoring and follow up also motivates a smaller area in Armenia compared to Sweden.

The pilot road is a part of the M 2, from Yerevan to the Iran border. The pilot road starts at km 187+130 (junction in Sarnakunk) and ends at the junction to Kaler (km 356+990).

9.3 Client – Supplier

9.3.1 Road Maintenance Project Manager

A key for success for Routine Maintenance by Contract is that ARD takes over the full responsibility for the implementation of the project and that a Project Manager with clear responsibilities is appointed at an early stage. Responsibilities and characteristics for a Project Manager could be:

Responsibilities	The Road Maintenance Project Manager shall, within a designated area:	<ul style="list-style-type: none"> — be responsible for the decided maintenance standard — procure, monitor and follow up maintenance services and activities — procure, monitor and follow up minor construction works — represent the Road Administration in all issues regarding the existing road network — follow the market situation
Characteristics	Priority to customers:	<ul style="list-style-type: none"> — Listen and act to the benefit of customers and interested parties — Inform customers and interested parties about the roads and road conditions — Deliver safe roads with a high degree of trafficability and a well developed service to the road users and a clean and attractive road environment. — Reduce the negative impact on the road environment from maintenance activities.
	Business:	<ul style="list-style-type: none"> — Act to get "value for money" by promoting competition and a development of the market for road maintenance. — Be known as an objective and competent client — Act to achieve an unified client behaviour within the road administration
	Simplicity:	<ul style="list-style-type: none"> — Work with efficient decision-making and extensive delegations — Work with non-bureaucratic methods in contact with customers and interested parties
	Quality:	<ul style="list-style-type: none"> — Adopt quality assurance on internal work with well defined routines — Demand Quality assurance from all contractors to guarantee desired quality Include road safety, environmental protection etc in quality assurance — Recognise and appreciate high quality

9.3.2 Enterprises

There are four enterprises in the pilot area. One enterprise is privatised, and one of the remaining ARD enterprises might be privatised 1998. The Enterprises have big organisations but work in small areas. The work is mainly ordered as specified activities and the payment is based on fixed unit rates. The main work load is patching potholes and cracks. This work is calculated in detail with the assistance of the Design Institute. Every square meter that has to be patched is shown in drawings. The institute also carries out tests of bitumen and aggregate. Subsequently there is a control of the amount and quality of work. Except for winter maintenance there is no work done using standard requirements.

9.3.3 Competition

There is no competition between the enterprises regarding routine road maintenance. For periodic maintenance all work is tendered, but the work is normally split in small pieces which reduces the real competition. Fixed unit prices are used, and there is no real experience of calculating the costs. Using fixed prices ought to give incentives for rationalisation but there seems to be no tradition to work with improvement of methods and more efficient use of staff and equipment. It was proposed that the pilot area should be in one contract and that the four

enterprises should compete. Contractors not awarded the Contract then could act as sub-contractors. As the tradition is to co-operate, not to compete, doubts about the effects of tendering have been raised.

9.4 Road Conditions

Road condition data are available from the road inspection survey carried out by DORPROJECT during the year 1996. The Following main condition data were collected:

- Cracks (Traverse and Longitudinal) in meters
- Alligator Cracks in square meters
- Potholes in square meters
- Roughness (IRI) in m/km

Road roughness is gaining increasing importance as an indicator of road condition and as a major determinant of road user costs. The standard roughness scale which has been used is the International Roughness Index (IRI). The IRI is based on simulation of the roughness response of a car travelling, which expresses a ratio of the accumulated suspension motion of a vehicle, divided by the distance travelled during the test.

For an easy outline of the result from the condition survey, the results were classified into condition classes, which were developed by TechEcon and Finnroad. The road condition classification is shown in the following table

Condition classification

Cracks	< 5	5 – 20	20 – 50	> 50
IRI (m/km)	%	%	%	%
< 4.0	1	2A	2B	2B
4.0 – 6.0	2A	2B	3	3
6.0 – 8.0	4	4	4	5
> 8.0	5	5	5	5

1 = good condition
2A = fair condition with cracking
2B = fair condition
3 = moderate condition
4 = poor condition
5 = very poor condition

The main part of the road in the pilot area has been rehabilitated during 1996 and 1997 and the rehabilitation work continues during 1998. 126 km of 170 km will be in good or fair condition when the pilot project starts in October 1998.

The detailed list of the maintained road sections is presented in the Road Inventory in the Bidding Documents. The condition of the remaining 44 km with “no action” during 1996 – 98 is summarised in the table below.

Condition of road sections with “no action” 1996-98

Condition class	1	2A	2B	3	4	5
% of area	1,4	7,8	6,8	0,7	38,1	45,2

9.5 Standard Requirements

9.5.1 Winter Maintenance

In areas with winter conditions during more than 100 days/year the winter maintenance could easily cost more than all other routine maintenance together. It is therefore very important to choose an adequate service level for every type of road. The service level could be decided based on traffic volumes or on functional criteria or on a combination of the two. As a base for discussion, three levels in Armenia were described and discussed.

High Service Level	National Roads	adt >2000
Medium Service Level	Regional Roads	2000<adt>500
Low Service Level	Local Roads	adt<500

Standard criteria could be maximum snow depth and friction demands. An alternative could be to decide the capacity for snow clearing and the trigger snow levels.

The three levels were compared with the service levels used in Armenia. The service levels in

Armenia demand activities after the snow has fallen or after the road has become icy. Then there is a maximum time within which the road should have got a desired standard regarding snow depth and cleared width. The main principal difference between Sweden and Armenia is that the Swedish service levels include preventive salting when icy conditions are expected and also includes maximum snow-depth during snowfall

In the seminar it was found that the climate situation in the pilot area is very special with the highest point of the road being more than 2500 m above sea-level. A discussion was held regarding possible changes of the Armenian standards for the pilot area. There was no agreement about changes. This issue has to be worked on further. In the bidding documents, the Armenian standard is shown.

9.5.2 Summer Maintenance

The repair of cracks and potholes dominates the total cost when the road maintenance has been neglected for many years. As the pilot area for routine road maintenance by contract mainly will comprise well maintained road (126 km and 44 km of road in poor condition), the question was raised, what will happen to all roads in poor condition if the standard requirements are upgraded in the pilot area. There is no simple answer to this. There is a conflict between preserving the upgraded road standard and to do emergency repair on roads in poor condition. But the question is very important as it underlines the importance of high efficiency in the repair work of Cracks and Potholes. Equipment especially designed for this kind of work and used in Sweden was demonstrated on a video.

One important idea in routine maintenance by contract is that the contractor should have a great responsibility and that he should be free to find more efficient ways to achieve a desired standard. This means that the requirements for equipment and methods will be replaced by road standard (service level) requirements. At the same time the work has to be possible to calculate without putting an unacceptable risk on the contractor. It was proposed that standard requirements only (paid with a lumpsum) could be used on the well maintained road, while patching should be paid with unit prices for actual work on the road in poor condition. In the seminar about Technical standard all summer maintenance services and activities were discussed and there was an agreement which to include in the pilot area. However the service levels have to be further discussed in order to find levels within available funding.

9.6 Bidding Documents for Routine Road Maintenance

Preliminary documents for Routine Road Maintenance has been presented and discussed to some extent. They are found in Appendix B. The documents are based on the standard documents for national bidding.

9.6.1 Standard Bidding Documents

Instructions to Bidders, Conditions of Contract, Standard Forms, General Specifications, Road Inventory and Bill of Quantities are included in Appendix B. Bidding Data and Contract Data will be added in phase 2. The differences between construction works and routine maintenance have, for the first three documents, mainly caused changes regarding work after completion date and payment procedures in a contract comprising both lump sum payments and payment for units actually completed and accepted. The contents in the other documents are described below. Alternatives to include an extended Bid Evaluation and requirements for Quality Assurance are attached.

9.6.2 General Specifications

The General chapter (0) is based on "General Specifications for Road Construction", but all other chapters are new. Standard requirements are based on the Swedish Standards except for Winter Maintenance, where the Armenian standard is chosen. Activities/operations paid per unit actually completed and accepted are incorporated from the specifications for road construction.

Those activities/operations include ditch clearance, patching, surface treatment etc. Requirements for the contractor's verification of achieved standard should be added in phase 2.

9.6.3 Road Inventory

The road inventory comprises basic data about length and width of the road, surface condition data, traffic data, bridge data, drainage data and data about road furniture. The main sources for information are the DORPROJECT and the pavement management system (PMS) used by ARD.

9.6.4 Bill of Quantities

The Bill of Quantities is based on the "General Specifications". Quantities are given for standard requirements only as they are related to the road length, the number of bridges, the length of guardrails etc. All other quantities have to be added in phase 2. Special attention should be given to winter maintenance as the way of payment easily could affect the total cost. The chosen alternative has to be revised when the standard levels are decided and the methods for monitoring and follow up the result and the resources used are established.

9.7 Evaluation of Bids

A Working Paper on the matter was presented and discussed at Seminar 6. It is not only the price that is important when competing bids are compared and evaluated. The bid should meet some minimum requirements to qualify for evaluation in the first place. These minimum requirements should be clearly spelled out in the tender documents. They would concern the contractor's experience, competence, resources, economic situation and if he has an acceptable approach to the project. If he has any reservation in his bid this should be analysed to find out if it disqualifies the bid. The bid should contain in a proper way all documents required in the tender documents.

In next step the acceptable bids are evaluated individually and in a third step compared with each other. There are a number of more or less sophisticated models available, but in the present case it is felt that a very simple model would serve the purpose best. The following factors should be analysed and evaluated.

Plan of work. The proposed approach to the project should be scrutinised, to make sure that the contractor has understood the project and that he has an efficient approach to it. In the case of the pilot project his approach to winter maintenance and pavement maintenance are of special importance.

Resources. The proposed set-up of plant and equipment should be well suited to the project. Composition, quality and number of different pieces of equipment should be evaluated.

Experience. The contractor should have sufficient previous experience of the type of work concerned.

Competence. The contractor should have competent (educated, trained and with documented ability) personnel, especially on key posts.

Price. The bid should be checked to make sure that all items asked for are included. Any reservations should be priced and added to the given price to arrive at comparable prices for all competing bids. The price should be analysed separately from the other evaluation in order to preserve objectivity.

The bids may be compared by means of a simple table as shown below. The price to compare can be adjusted (downwards) in relation to the number of surplus points gained.

Criteria	Bid A	Bid B	Bid C	Bid D
Minimum requirement met? (OK or -)				
Plan of work (surplus value if any, 0-3p)				
Resources (surplus value if any, 0-2p)				
Experience (surplus value if any, 0-2p)				
Competence (surplus value if any, 0-2p)				
Price (adjusted for any reservations)				
Adjusted price to compare				

9.8 Monitoring and Follow up

This is a key for success. Routines, methods have to be established before the work in the pilot area starts. An extensive training of client and suppliers is necessary.

The bulk of monitoring work should be done by the contractor and reported to the Project Manager. The Contractor shall also verify the achieved standard according to General Specifications.

ARD has no regional organisation except from the enterprises. A Project Manager is likely to work from Yerevan, and he will have no resources in the pilot area for monitoring and follow up. A system for Quality Assurance was presented in seminar 6. The introduction of Quality Assurance and a Quality Plan for the Pilot Area could be one tool. Monthly Management Meetings is another tool. The Project Manager also needs methods for random tests of the standard on the road. Such tests compared with the standard according to the contractor's quality plan should be one item on monthly meetings. On those meetings it could also be decided which work to carry out during the following month. The possibility to use staff from the municipalities for monitoring the standard should also be examined.

9.9 Risks

The main risk is that the first step will be too big and that there will be too little time for training of the people involved to change attitudes and learn how to act in competition. The existing contract system is based upon activities, where the Employer decides every activity and pays a fixed price. A main problem is to control the work, that the work has been done and with the desired quality. This problem is big for construction work, but even bigger for maintenance work, as the standard requirements should be obtained all the time. And you cannot have a minute by minute monitoring system. A contract for routine maintenance within a defined area has to rely on mutual confidence combined with quality assurance and random tests of the standard done by the Employer. It is a big step, both for the client and for the suppliers, to go from ordering well specified activities to ordering a day by day standard, and to control the result on the road only and not the activities.

9.10 Plan for the Pilot Study

The implementation of Routine Maintenance by contract is planned to start in the Pilot Area 1998. A Project Synopsis, a Work Programme, and a Project Budget are proposed.

9.10.1 Project synopsis for the pilot study

Wider project objectives	An improved road transport system..
Specific project objective[s]:	Learning for routine maintenance by contract system with a pilot project. (Phase 2 and 3)
Planned outputs:	<ol style="list-style-type: none"> 1 Tender documents and procedure for Pilot Project "Routine Maintenance by Contract" in the selected Pilot Area; 2 Implementation and Follow-up of Pilot Project
Project activities	<ol style="list-style-type: none"> 1 Mobilisation of team, <ol style="list-style-type: none"> 1.1 Introductory visit at ARD, arrangement of logistics; 2 Management Development <ol style="list-style-type: none"> 2.1 Review of Goals and Strategies 2.2 Review of Routine Maintenance Standards 2.3 Introduction to management training 3 Bidding Documents for Routine Maintenance <ol style="list-style-type: none"> 3.1 Updating of inventory of the pilot section 3.2 Standard Bidding Documents 3.3 General Specifications 3.4 Bill of Quantities 3.5 Quality Assurance (QA) 4 Bidding procedure <ol style="list-style-type: none"> 4.1 Bid evaluation 4.2 Approval of Work Programme for the pilot project 4.3 Award of Contract 5 Pilot Study <ol style="list-style-type: none"> 5.1 Monitoring of road condition 5.2 Follow-up of costs and resources 6 Final Report
Project starting date:	March 1998 (Suggested)
Project duration:	20 months (October 1999)

9.10.2 Work Programme for Pilot Project

Project title: Routine Maintenance by Contract Pilot Study Planning period: 3/1998 - 10/1999 Project objectives: Assistance to the Armenian Road Directorate in the Development of a Routine Maintenance Contract System		Project number: Armenia Prepared on: 6/12/1997 EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany												Page: 1								
		TIME FRAME												INPUTS								
No.	Main Activities	1998 Months						1999 Months						PERSONNEL		EQUIPMENT AND MATERIAL	OTHER					
		J	F	M	A	M	J	J	A	S	O	N	D	J	F			M	A	M	J	EC Consultant
1	Mobilisation of team.																			1 week		
1.1	Introductory visit at ARD, arrangement of logistics;	X																		1 week		
2	Management Development																					
2.1	Review of Goals and Strategies	X																		2 weeks		
2.2	Review of Routine Maintenance Standards	X																		6 weeks		
2.3	Introduction to management training																			25 weeks		
3	Bidding Documents for Routine Maintenance																					
3.1	Updating of inventory of the pilot section	X																		1 week		
3.2	Standard Bidding Documents																			2 weeks		
3.3	General Specifications																			4 weeks		
3.4	Bill of Quantities																			4 weeks		
3.5	Quality Assurance (QA)																			7 weeks		
4	Bidding procedure																					
4.1	Bid evaluation																			4 weeks		
4.2	Approval of Work Programme for the pilot project																			3 weeks		
4.3	Award of Contract																			2 weeks		
5	Pilot Study																					
5.1	Monitoring of road condition																			20 weeks		
5.2	Follow-up of costs and resources																			20 weeks		
6	Final Report																			1 week		
								Total						40 weeks	113 weeks							

9.10.3 Project Budget for Pilot Study

Below is a tentative draft budget in ECU for Consultant input in the Pilot Project, as a basis for budget discussions.

Fee			
Item	Quantity	Rate, ECU	Total, ECU
1 Senior engineers, 8+8*) weeks in Armenia, including planning and preparation	16	3 300	52 800
2 Management expert, 1 week in Armenia, including planning and preparations and for supplying training software etc.	1	8 000	8 000
3 Engineer, 10+7 weeks in Armenia, including planning and preparation	17	3 300	56 100
4 Backstopping, 3+3 weeks	6	3 300	19 800
Subtotal Fee			136 700
Reimbursable			
Item	Quantity	Rate, ECU	Total, ECU
1 International travel, Europe - Armenia, 8+6 return tickets (excursion)	14	2 200	30 800
2 Daily allowances, 280 days*ECU 75	280	75	21 000
3 Car Rental and driver services in Armenia, 3.5 months	6.5	800	5 200
4 Translator and secretarial services in Armenia 80+50 weeks	130	25	3 250
5 Production of workshop material and literature			2 000
6 Printing of reports			4 000
7 Consumables and freight			2 000
8 Telecommunication	42	200	8 400
9 Contingencies,			1 000
Subtotal Reimbursable			77 650
Total			214 350

*) The first figure refers to Phase 2 and the second to Phase 3

9.10.4 Team of Consultants

A team of consultants will carry out the work. The names and the tasks are summarised as follows:

1. FRANK GRANBERG - Project Manager.

Mr. Granberg will be responsible for the planning and implementation of the different project activities. He will pay special attention to the preparation and presentation of the different reports of the study.

2. SVEN ODÉN - Senior Road Engineer and Maintenance Management Expert

Mr. Odén will assist the Project Manager in his work and assume the overall responsibility for all technical aspects of the study.

3. CARSTEN GRIESE - Road Engineer and Road Maintenance Expert

Mr. Griese will be responsible for the road inventory work as well as all other field activities. Mr. Griese will be stationed in Yerevan for most of the study period

4. JOHN HANDLEY - Senior Management Expert

Mr. Handley will be responsible for initial management training and for outlining a programme for continued management training of ARD and Enterprises managers.

10. RECOMMENDATIONS

10.1 Financing

A reliable and stable system for financing ARD's activities is a prerequisite for a meaningful Pilot Project and an efficient modernisation of road maintenance. The Road Fund concept has to be passed through legislation and implemented more or less immediately. The succeeding recommendations are based on the assumption that the financing problem will be solved.

10.2 Pilot Project

The described programme and organisation of a Pilot Project will give valuable experience for the parties involved both ARD and the winning contractor. Before the finalisation of Tender Documents in Phase 2 of this project ARD should have scrutinised and completed the draft documents attached to this report. In conjunction with the evaluation of bids for the Pilot Study a strict review of all conditions for the study should be done before a contract is signed. The entire Pilot Project Phase 2 and 3 should be given a go-ahead, with a possibility to cancel it after Phase 2 if unforeseen circumstances occur.

10.3 Training

10.3.1 Rationalisation

The enterprises are the main target group for rationalisation training. There is a great potential to improve productivity by means of more efficient work methods and equipment. The consultant recommends a programme for training of trainers for Rationalisation Engineers. A Rationalisation Engineer should train two or three experienced engineers (5 years experience) from a country with a modern and rational maintenance set-up. The objective of the training is to teach methods for measuring productivity and analysing work methods, and enable them to make a programme for training new engineer and to implement the training programme. Emphasis should be on the road sector.

10.3.2 Introduction to rationalisation training.

The objective is to train a limited number of engineers in the concept and techniques of rationalisation in order to enable them to train other engineers. The target is the new enterprises which have a low productivity and efficiency, partly as an inheritance from the earlier political system. A first training input should last for a week and a suitable schedule could be as follows.

Day	Subject	Time, hrs
1	Introduction: "Why rationalisation"	2
	Capacity – fundamentals	6
2	Capacity – simple time analysis, video	3
	Volume, transport and digability, basic elements.	5
3	Processing – simple time study	3
	Work methods	5
4	Calculating capacity	8
5	Cost calculations	5
	Summary and conclusions	3

Experience from this introductory session will form the base for planning of following sessions and activities. Practical studies in the field should follow with time studies, calculation of capacity and costs, comparison of different study methods, calculations for chained production processes. The estimated time for these following sessions is in the order of two weeks. Estimated costs: approximately 15 000 ECU.

10.3.3 A practical demonstration of efficient work methods

Another more direct and practical way to rationalise and illustrate the potential of rationalisation is to provide ARD, either directly or through an enterprise, with a piece of equipment with instructors and support over a period of time. The equipment, which has been discussed between ARD and the Consultant, is a Swedish make truck attachment for mending potholes and similar damages to the road. Depending on whether or not the equipment can be fitted on an existing truck the costs are very roughly estimated to be in the order of 100 000 and 200 000 ECU, respectively. The cost for the outfit including operator and material would in Western Europe be in the order of 100 ECU/hr. If it at least not is more expensive to operate in Armenia, this would mean that pothole patching could be done for half the present cost with methods used in Armenia.

10.3.4 Management support

In the development of ARD and of the enterprises it is important that efficient management approaches are employed. The following programme is recommended as an introduction and a test.

An Introduction to People and Business Management

Objective	A pilot programme to introduce key concepts and techniques in People and Business Management. (To determine level of future support to ARD and Enterprises)
Target Group	ARD (incl. PIU) Managers and invited/selected Heads of Enterprises. Approximate number of participants: 25-30 people.
Method	A 5-day programme entitled "An Introduction to People and Business Management". A graded sequence of short lectures and discussions supported by participative individual and group activities demonstrating key aspects of people and resource management. A special feature of the programme to enhance the learning opportunity will be the business game, involving decision-making in the main functions of business, e.g. Finance, Marketing, Operations, Research, to provide a challenging and practical way of putting into practice many of the ideas and techniques discussed during the programme.
Content	The programme will include: <ul style="list-style-type: none"> 0 The process of Management 1 Decision-Making – Individual and Group 2 Time Management, Delegation and Communication 3 Theories of Perception, Motivation and Group Behaviour 4 Management Styles and Effective Team Performance 5 Managing in a Competitive Market Economy 6 Management of Change
Staff	Mr. John Handley, Head of Cranfield Business Games at Cranfield University, Bedford, UK, will run the programme. He has an excellent record in the field of management. He has been running similar courses and Business Games in programmes financed by Tacis for participants from CIS countries.

This first introductory session is included in the planning for phase 2 of the project, estimated costs are in the order of 10 000 ECU, including travel and preparations.

10.4 Road administration and responsibility for other classes of roads and streets

Although city streets and other roads than Highways and Republican roads are not the responsibility of ARD, it is obvious that there is a need both for rehabilitation and for maintenance of these roads. Financing is also a problem for these roads, as well as the organisation of maintenance. The Consultant recommends that this problem is looked further into.

APPENDIX A - SEMINARS

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Seminar 1 - Privatisation – Commercialisation – Client /Supplier

Date: 3 October 1997.

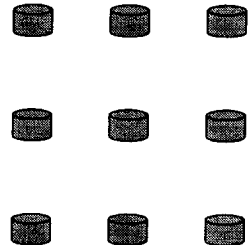
The purpose of Seminar 1 was to open a communication with the management of ARD and their staff.

Participants:

P. Kartchikian	Deputy Director General
A. Shikanyan	Deputy Head of Road Operation Department
B. Kazaryan	Head of Planning Department
R. Srapyan	Head of Projects and Contract Preparations Department
G. Melkumyan	Main Advisor of ARD
R. Atabegyan	Main Advisor of ARD
H. Petrossyan	Planning Coordinator, PIU
S. Hakobyan	Design Preparation Coordinator, PIU

The seminar was run by Mr. F. Granberg and C. Griese from the Consultant

Introduction and invitation consisted of the picture with the 9 dots, which have to be connected with 4 straight lines. The message is that one should try to widen ones mind outside traditional boundaries.



1.1 Privatisation – Commercialisation – Client /Supplier

1.1.1 Why Privatisation?

Experience throughout the world has shown that most field activities which by tradition has been executed by a state owned organisation like a road administration can be done cheaper and better – more efficient – by a privatised and commercialised type of organisational structure, where there is competition and incentives in the form of profit or similar.

1.2 What is an efficient Client?

1.2.1 The Road Agency

If maintenance work is entirely let to contractors, the Road Agency, which used to be responsible for everything from long-term planning to day-to-day maintenance activities, changes to an Agency responsible for supplying the public with an efficient and safe road system at minimum costs.

The Agency is the manager of the road network, receiver of the financial means and acting as the Authority in matters delegated to it. All production is let to tender.

A major problem for the Agency is that all work and services must be carefully defined to ensure that the contractors understand the intention with regards to the service required and product delivered.

In order to purchase maintenance services at the minimum cost, the Agency must ascertain that the contract attracts maximum competition, which is not difficult for Enhanced or Periodic Maintenance. These services are easy to define and quantify and have been purchased by tendering for many years. For Routine Maintenance it is necessary to describe the service precisely to enable all contractors to offer a tender at a fixed price.

A competent purchaser always,

- purchases exactly what is required at minimum TOTAL cost.
- is precise as to the required product.
- requests fixed price from numerous suppliers.
- checks that he has got what he has paid for.

1.3 What is a successful Supplier?

1.3.1 The Contractor

The traditional, proven organisation used by most contractors will be satisfactory for Periodic or Enhanced Maintenance, specifically a product to be "manufactured and delivered" according to drawings, technical specifications, time schedule, etc.

Routine maintenance is an on-going activity where the staff continuously monitors the road network. Decision-making and speedy action is often necessary to maintain the function of the road system. The contract, therefore, should cover a geographical area the size of which is suitable for full time supervision of at least one person. A large area has the flexibility necessary for efficient production planning. An area containing 500 kms of roads could be a reasonable network for a contract suited to a well-equipped contractor of reasonable capacity. Big and comprehensive contracts favour big contractors and might eventually lead to a monopoly situation.

1.3.2 ARD's present organisation and where it is heading.

This is from the project proposal:

It is important to spend sufficient time and efforts on clarifying the ultimate objectives of the projects. As a base for the discussion and analysis could serve a vision of the future based on facts, intuition and imagination. Among factors considered could be the culture and characteristics of Armenia and comparisons with countries, which are more experienced in the ongoing evolution of the public sector, especially the road sector.

When the present situation is compared with an ambitious vision of a distant future one might find that some realistic limitations has to be applied to the vision to make it sufficiently ambitious and focused on the roads. This could result in a vision for ARD, and serve as a base for the formulation of adjusted and detailed objectives for the project and the development of ARD. Based on the tentative vision and an evaluation of the present situation in Armenia, including a comparison of organisation and resources between Armenia and European countries, a detailed vision for a 5 to 10 years period will be done and serve as a base for a new strategy.

The following is an example.

The road network in Armenia is available for road users all the year round.

Normal speed, 70 - 90 km/h can be used except during extreme weather conditions. During the thaw-period, however, there could be load restrictions for heavy traffic and reduced speed for other vehicles.

The ARD is a client organisation with competence to buy routine maintenance. ARD has a QA-system with well-defined routines,

- to produce tender documents,
- to evaluate the bids and choose the best contractor and
- to follow up that the standard requirements are fulfilled

There are several competent contractors with efficient organisations for routine maintenance. They have QA-systems that ensure that the road users get a road standard according to the tender documents.

The standards for routine maintenance are described in measurable terms, possible to control

Alternative forms of contract for routine maintenance are used in order to take advantage of the present market situation and to give the contractors an incentive for development and efficiency.

1.3.3 Headings for the discussion:

- Standard and condition of different classes of roads in different seasons from a road users point of view.
- ARD as a client organisation – its competence, especially with respect to routine maintenance
- ARD's organisation, size, personnel policy.
- Availability and competence of contractors for routine maintenance
- Our vision of ARD as a client organisation.

1.3.4 A future organisation of ARD and its Suppliers

1.3.5 Whats next? How do we get there.

- Could you tell me, please, which way I ought to go from here?
- That depends a good deal on where you want to get to, said the Cat.
- I don't much care where, said Alice.
- Then it doesn't matter which way you go, said the Cat.

Seminar 2 – Pilot Study

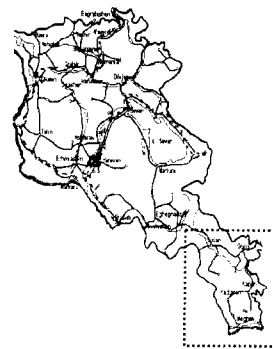
Date: 8. October 1997.

Mr. Carsten Griese informed about this subject as one item in conjunction with a presentation by FinRoad with the following main subjects.

- A. Material and Plant Standards
- B. Winter Maintenance
- C. Azerbadjan Institution Building
- D. Road Pavement and Bridge Testing
- E. Road/Rail Pre-feasibility Study in Kirgistan, Kasakstan with connection to China

The selected area for the Pilot Project is situated. The selected area contains 170 km of Highway, which is rehabilitated or will be rehabilitated shortly. The Pilot section starts at km 187+130 and ends at km 356+990.

There are 44 km of Highways which are presently not in the programme for rehabilitation and has a relatively low surface standard. There are also some 157 km of Republican roads in the area, which presently are not considered as part of the pilot project. The selection was accepted by the Consultants as it is a main Highway of great importance, and most of it is brought up to a maintainable standard.



Pilot
Area

Seminar 3 - Goals and Strategies for (Routine) Road Maintenance – Planning Levels

Date: 20 November 1997.

The purpose of Seminar 3 was to identify and discuss the main goals and strategies for (routine) road maintenance.

Participants:

Kartchikian P.	Deputy Director of ARD
Akopian S.	Coordinator PIU
Badalian K.	Engineer PIU
Badalian. J	Head of ARD dept.
Kazarian P.	Head of ARD dept.
Marcosian R.	Coordinator ARD
Petrossian A.	Coordinator PIU
Shikanian A.	Deputy head of ARD dept.
Srapian R.	Head of ARD dept.

The seminar was run by Mr. Sven Odén from the Consultant

3.1 Goals and strategies

The goals and objectives gives the framework for the road sector, but gives little help in the situation when competing wishes and ambitions have to be prioritised and fitted into a narrow economic frame. The objectives might be restructured and grouped as follows.

- Maintain the capital invested in roads
- Improve transport economy
- Improve traffic safety
- Establish an environmentally friendly transport system
- Integrate with other transport systems
- Satisfy the needs of people and the national economy
- Develop a sustainable financing system for road maintenance

The main objective for maintenance of roads is to preserve the economic and technical value of the very large capital represented by the road network. Negligence of maintenance will result in rapidly accelerating deterioration of the investment, which in term affects the other goals negatively. One way to give a structure to the discussion about priorities and preferences of road maintenance is to study to what extent a certain maintenance activity has effect on different objectives. This was done during the seminar, but it was also discussed which goals are most important to make it possible to carry out the most important maintenance activities. The discussion was based on Road Traffic Goals in Sweden and the State Road Policy in Armenia. After discussion, the goals on which maintenance activities have the greatest impact were:

- To promote the interest of road users
- To promote traffic safety
- To Preserve road capital
- The most important goals to make it possible to carry out maintenance activities were:
 - To introduce market economy in the road sector
 - To arrange stable financing for roads
 - To establish modern planning system
 - To introduce and implement a priority system for road construction, improvement, rehabilitation and maintenance

The table below shows the summary of the discussion in the seminar

Maintenance Activities, Effects on Goals and Importance of Goals

Maintenance Activity	Effects of maintenance activities on following goals			Importance of following goals for efficient road maintenance			
	Preservation of capital	Promote interests of road users	Traffic safety	Market economy	Stable financing	Modern planning system	Priority system
Winter maintenance							
Snow clearing	small	large	large	large	medium	medium	medium
Salting	small	large	large	large	large	small	small
Paved roads							
Routine	large	small	large	large	large	small/ medium	small/ medium
Periodic	large	large	large	large	medium	medium	medium
Gravel shoulder	small	large	medium	small	large	small	small
Gravel roadway	large	large	large	large	large	large	large
Drainage	large	medium	medium	medium	medium	medium	medium
Bridges	large	large	medium	large	large	large	large
Road signs and markings	small	large	medium	small	small	small	small
Grass cutting & bush clearing	small	large	medium	small	small	small	small

Such a simple table might form the basis for discussion of priorities in different financial situations, both in the advance planning for a new year and during a year if and when unforeseen events makes it necessary to slim the running budget. The content and the evaluation of the table is also a matter for discussions as different experts probably have different views. Depending on the degree of importance of the different political objectives, priorities can easier be made between activities, which have a great effect on transport costs, and those, which promote traffic safety.

If all goal aspects have equal value, then activities, which have a significant positive effect on several of them, should be given higher priority than others should. Winter maintenance and maintenance of paved roads is falling into this category although salting is undesirable from an environmental point of view.

3.2 Planning levels

It might be convenient to design the maintenance plan for three different funding levels. The first one, the **Goal Level**, represents the funds, which correspond to the full policy for road maintenance, as indicated by the Government. The second level, the **Budget Level**, corresponds to the most likely funding level for the coming budget period. A third level. **Cut Down Level**, describes the strategy to be chosen if the funding level will be less than expected. In this manner there will be preparedness for changes rather than a strict and rigid plan.

The **Goal Level** is the funding level which incorporates a volume of maintenance operations which is optimal in relation to Government's policy. This is the level when the socio-economic effects breaks even with the financial costs of the maintenance programme. The goal level includes funds required to gradually eliminate the backlog from previous years.

The **Budget Level** is based on the current level of funding or the best guess of the level for the coming year. Budget Level is lower than the Goal Level and the funds are inadequate to cover all economically justified maintenance needs.

Priority is to be given to operations according to the strategy chosen with help of the structure illustrated in the table above.

The Cut Down Level is useful for both analysis of the flexibility in the maintenance organisation and to create preparedness if the funds become less than anticipated. A plan at this level should result in effective operations although at a lower level than originally planned.

The Normalised Minimum Level is in this case an in-between level, which does not include any compensation for the backlog.

During discussion it was said that the ARD budget for routine maintenance only covers 15-20% of the goal level. That means that it is below cut down level! Table 3.1 is a principal example how the situation can be dealt with. In reality there has to be a considerable amount of calculations, discussions and considerations to arrive at an acceptable solution. However, during the seminar the result in the table was agreed upon by the participants.

Planning levels.

Funding Level	Additional volume of these activities	Less of these activities
Goal Level 1)		
Normalised Minimum Level2)	Pavement maintenance, routine and periodic.	Periodic pavement
Cut Down Level -	Maintenance emergency repair	

1) This level was to far away from the actual situation to be discussed

The value of the present state road network in Armenia may very roughly be estimated at something like 1000 million USD. To compensate for depreciation it can be advocated that a certain percentage of this value should be used for maintenance and improvement of the network each year. The road network seems sufficiently dense in an international comparison, and there does not seem to be any missing links, although some are of inadequate standard. Therefore very emphasis has to be put on maintenance and improvement of the existing network.

Seminar 4 - Maintenance Standards – General Technical Standard

Date: 21 November 1997.

The purpose of Seminar 3 was to identify, discuss and set the maintenance standards for the Pilot Project.

Participants:

Karchikian P.	Deputy Director of ARD
Akopian S.	Coordinator PIU
Badalian K.	Engineer PIU
Badalian. J	Head of ARD dept.
Kazarian P.	Head of ARD dept.
Marcosian R.	Coordinator ARD
Petrosian A.	Coordinator PIU
Shikanian A.	Deputy head of ARD dept.
Srapian R.	Head of ARD dept.

The seminar was run by Mr. Sven Odén from the Consultant

4.1 Standard description

The possible maintenance standard can preferably be expressed as a series of standard description of the different maintenance activities.

4.1.1 Winter maintenance

In areas with winter conditions during more than 100 days/year the winter maintenance could easily cost more than all other routine maintenance together. It is therefore very important to choose an adequate service level for every type of road. The service level could be decided based on traffic volumes or on functional criteria or on a combination of the two. In Sweden there are 6 different service levels, but they might be reduced to three or four levels. As a base for discussion, three levels could be used in Armenia.

High Service Level	National Roads	adt >2000
Medium Service Level	Regional Roads	2000<adt>500
Low Service Level	Local Roads	adt<500

Standard criteria could be maximum snow depth and friction demands. An alternative could be to decide the capacity for snow clearing and the trigger snow levels.

In the Southern part of Sweden the resources used during the winter season 1996/97 were monitored. The results are shown in the graphs below. This winter comprised 100 days with snowy and icy conditions. 25 days had more than 0,5 cm snow. The resources used in high service levels (A1-A3) are twice the resources used in medium levels (A4 and B1) and four times the resources used in low levels (B2). Salt is mainly used in the high service level and sand in medium and low service levels.

The Swedish service levels were compared with the service levels in Armenia. The service levels in Armenia demand measures after the snow has fallen or after the road has become icy. Then there is a maximum time within which the road should have got a desired standard regarding snow depth and cleared width. The main difference between Sweden and Armenia is that that the Swedish service levels include preventive salting when icy conditions are expected and that they include maximum snow- depth also during snowfall

In the seminar it was found that the climate situation in the pilot area is very special with the highest point of the road being more than 2500 m above sea-level. A discussion was held regarding possible changes of the Armenian standards for the pilot area. There was no agreement about changes. This issue has to be worked on further.

4.1.2 Pavement maintenance

is very much taken care of by the new PMS system, which seems to be well organised and well on its way to become fully functional. The present conditions and the expected conditions in mid 1998 were presented as a base for discussion, see separate description of the pilot area. Out of 170 km, 126 km will have a well maintained standard. Of the remaining 44 km 36 km are in poor or very poor condition. Pothole repair, crack sealing are routine maintenance activities, which should be given high priority to halt the destruction of the pavement and to achieve an acceptable riding quality of the road surface. The different maintenance activities concerning paved road were discussed as follows.

Trafficability

Roads in the pilot area should be allowed for 10 tonne axle load all the year round. No axle load reduction is allowed during the thawing period or during any other time. This will cause extra costs for repairing the roads.

Drainage

The function of the drainage is of vital importance for preserving the road capital and the contractor should guarantee that the function is continuously in good order. The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used as a base for further discussion.

Slopes

The demand for stable slopes should be included in the contract but the detailed requirements should be further discussed.

Cracks and Potholes

126 km of the road will be in a maintainable standard. For those kilometres the requirements should be that potholes bigger than shown in table XX are not allowed. A bigger pothole should be repaired within a week. For the remaining 44 kilometres the requirements should be the same, but the contractor should contact the client before doing the repair work. The ways of payment has to be further discussed.

Friction

The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used.

Road free from obstacles

should be included. The requirements could be:

The carriageway shall be free from physical obstacles that can cause road accidents or negatively affect the trafficability. Abandoned cars, stones, trees fallen across the road, old tyres, and dead animals and flooding are examples of physical obstacles.

Road markings

Requirements for roadmarkings should be included but the details should be decided later. Further discussion is needed.

Edge support strip

The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used.

Gullies and inlet covers

The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used.

4.1.3 Roadside Area

Clearance for visibility, width of visibility and clearance for height should be included, but the requirements in Armenia should be decided later. Further discussions are needed.

4.1.4 Road Furniture

4.1.5 Guard rails

The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used as a base for discussion. Service level will be decided after further discussion.

4.1.6 Road signs

The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used as a base for discussion.

4.1.7 Bridge maintenance

is given priority in present maintenance planning. It should continue to be given high priority, with regard to the present condition of existing bridges and the consequences of a bridge failure. There are three components in this, regular and efficient bridge inspection, annual cleaning and maintenance of all existing bridges, and a programme for rehabilitation or replacement of damaged bridges. The routine maintenance contract should include regular visual inspections and minor repair. The standard used in the attached document, "General Technical Description for Routine Road Maintenance" will be used as a base for discussion. Bridge maintenance should be replaced by "Maintenance of artificial structures" and include walls and big culverts.

Seminar 5 –Tendering Strategy

Date: 25 November 1997.

The purpose of Seminar 5 was to identify and discuss possible tendering strategies for Pilot Project.

Participants:

Karchikian P.	Deputy Director of ARD
Akopian S.	Coordinator PIU
Badalian K.	Engineer PIU
Badalian. J	Head of ARD dept.
Kazarian P.	Head of ARD dept.
Marcosian R.	Coordinator ARD
Petrosian A.	Coordinator PIU
Shikanian A.	Deputy head of ARD dept.
Srapian R.	Head of ARD dept.

The seminar was run by Mr. Sven Odén from the Consultant

Strategy means the way from where we are now to a future goal or vision. If you don't know where you are going then it doesn't matter which way you take as the cat said to Alice in Wonderland when she was lost in the forest (see seminar 1). Therefore it is necessary to have a goal or a vision of the future routine road maintenance in Armenia before the strategy is defined.

A vision might be the way Swedish routine maintenance is done today, which means

- Less staff - decent salaries
- Better equipment
- Higher efficiency
- Bigger maintenance areas
- Real competition

The objective of this seminar is to discuss the role of the Client and to what extent maintenance should be bought as functions, standards, activities and resources. It is the process of moving from doing all routine maintenance in-house to letting all field activities to contractors. There are a number of intermediate steps in this development, which could serve as alternatives for a new organisation. The following content from the Terms of Reference was discussed.

5.1 A New Strategy - A Process of Change

The transformation of the present organisation towards an ambitious vision of the future can hardly be done in one step – it probably requires many small and tedious steps in a more or less continuous process of change. The vision will very likely change on the way through this process. A strategy and a plan for development has to be worked out and adopted in the ARD, and known and accepted by all involved.

To achieve the vision for the road network, it is initially necessary to separate the “client” and “supplier” functions and to manage routine road maintenance according to commercial principles. Suppliers will be the newly established cadres of Construction Enterprises. The process is suggested to be done in steps of different duration and include the organisation as a whole.

- Step 1. Separate the “client” and “supplier” functions of road maintenance (including both periodic and routine maintenance). Establish a buyer-seller relation within the ARD but keep skills for work management and supervision in the client's organisation. Buy routine maintenance as well specified activities on a short-

term basis like periodic maintenance. This means that the major risks remains with the client. There is an ARD-owned plant pool, which could remain temporarily during this intermediate stage.

Step 2. Increase the contents and extend the time of the contracts. Contractors to do all supervision. The client should reduce resources for work management and supervision. The suppliers should be fully responsible for plant and equipment. Tendering procedures are used and private contractors could be competing with the ARD "suppliers" in a pilot region.

Step 3. Procure routine maintenance for a specific road network during 2-4 years. The contracts include both standard requirements and specific activities to be carried out. Contractors should own plant and equipment.

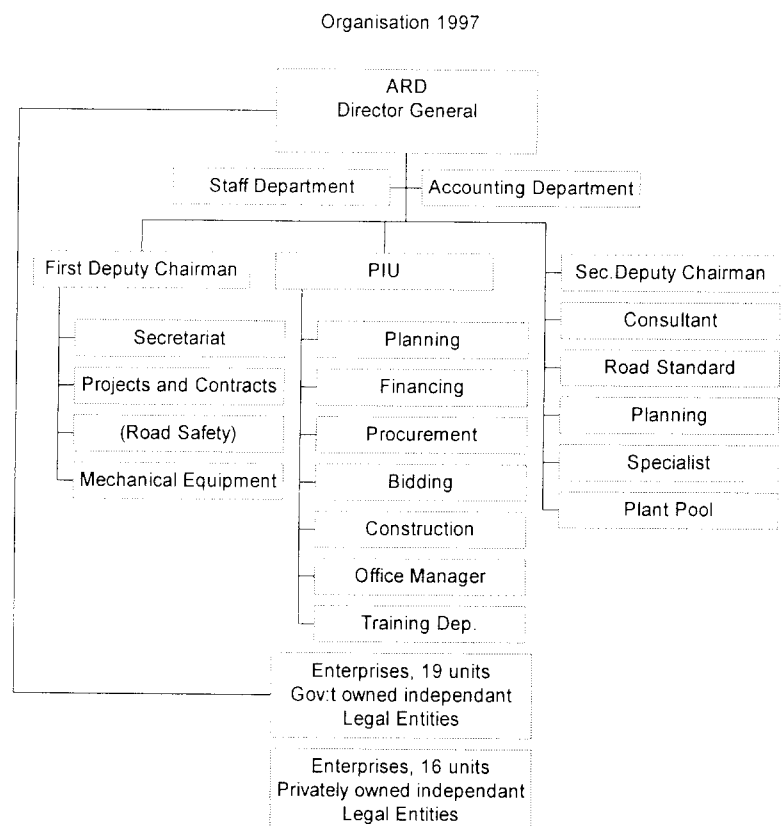
Step 4. Procure routine maintenance with service level standard requirements only, for a period of 4-6 years.

The present organisation of ARD was discussed and it was found that the first step is to a great extent achieved as the Enterprises are independent legal entities under the Director General. Several enterprises have been privatised and the goal is that 1999 all but 16 or 17 enterprises should have been privatised. However, the role of the client is not quite clear but it was proposed that the Planning and Development department should be the client although the tendering should be the responsibility of the First Deputy Chairman and done through his unit for Projects and Contracts. The importance of the client being involved in the tendering procedure from the start was pointed out.

The Swedish strategy for tendering routine road maintenance was used as a base for discussion. A lively discussion followed and there were different opinions about advantages and disadvantages of including all maintenance activities in a maintenance area. The main objection to include all activities was lack of funding. It was decided that this should be further discussed in the seminar about Bill of Quantities in order to find solutions where the client have the possibility to reduce the amount of work to a limited budget. This means that the standard requirements for some activities should only be carried out if they are approved by the client.

The proposal in the seminar was that the contract should include maintenance activities within a road network and that the number of activities and the content (standard level of each activity) should be further discussed.

The market situation in the pilot area was discussed. There are four enterprises in the area today, one private enterprise and three ARD enterprises. One of the ARD enterprises might



be privatised during 1998.

The following proposals about tendering model for the Pilot area were discussed.

A. One contract for all ARD roads in the area.

Separate the roads in three groups for different standard requirements:

12,6 km well maintained highway

4,4 km highway in poor condition

150 km republican roads

Winter maintenance with standard requirements

High service level for highways

Medium or low service level for republican roads

Routine maintenance of paved roads with

standard requirements only for well maintained highway,

standard requirements, but work done after approval of client for highway in poor condition.

emergency repair done after approval of client for republican roads

All contractors within the area should compete, but only one contractor should be awarded the contract. This contractor then could use the remaining contractors as sub-contractors.

B. Two or more contracts for ARD roads in the area.

Separate the roads in two groups for different contracts.

170 km highway

150 km republican roads

The first contract will have the same standard requirements as highways in alternative A.

All contractors within the area should compete, but only one contractor should be awarded the contract. This contractor could use the remaining contractors as subcontractors, but they could also be given maintenance of republican roads directly by ARD, using similar contract forms.

In the discussion the funds available were the main issue. There were different opinions about which standard to choose and which roads to include in the pilot area. Three main alternatives could be sorted out:

Include all the 170 km of highway and choose an appropriate standard/service level that will satisfy goals regarding preservation of road capital, road safety and transport costs.

In this case extra money is needed.

Choose standard/service levels that within a few years can be adopted on all highways and choose a typical Armenian highway

Choose only 5 km of highway and test a high standard/service level and the tendering procedure.

In the discussion it was emphasised that the idea with tendering should fail if the area is too small, because the contract will comprise too little money to make rationalisation possible. A small area will also limit the interest from contractors outside the area to compete. If there are no funds available for a bigger area, then the tendering should be postponed and the project should concentrate on using more efficient methods. But that will not be according to the terms of reference.

Standard/service levels and the size of the pilot area have to be further discussed.

Seminar 6 - Tender Documents and Procedure

Date: 27 November 1997.

The purpose of Seminar 5 was to identify and discuss tender document and procedures for the Pilot Project.

Participants:

Karchikian P.	Deputy Director of ARD
Melkumyan.G	Deputy Director of ARD
Mkrtchyan.G	Second Deputy Director of ARD
Akopian S.	Head of Department PIU
Petrosian A.	Head of Department PIU
Badalian K.	Analytic Engineer PIU
Kazarian P.	Head of ARD dept.
Shikianian A.	Deputy head of ARD dept.
Sarkisyan.G	Deputy Director of PIU
Badalian. J	Head of ARD dept.
Darbinyan.S	Head of Vanadzor Enterprise
Petrosyan A.	Head of Echmiadzin Enterprise
Akanyan S.	Head of Tumanian Enterprise
Gevorkyan K.	Head of Vaik Enterprise
Voskanyan N.	Head of Goris Enterprise
Mnackanyan M.	Head of Talin Enterprise
Ahumyan D.	Head of Nairi Enterprise
Arakelyan K.	Head of Maralik Enterprise
Darbinyan Kch.	Head of Ashotsk Enterprise
Akopyan R.	Head of Gavari Enterprise
Avakyan G.	Head of Tavush Enterprise
Nazayan K.	Head of Gavar Enterprise
Akopyan L.	Head of Yerevan Enterprise
Airapetyan L.	Head of Kapan Enterprise

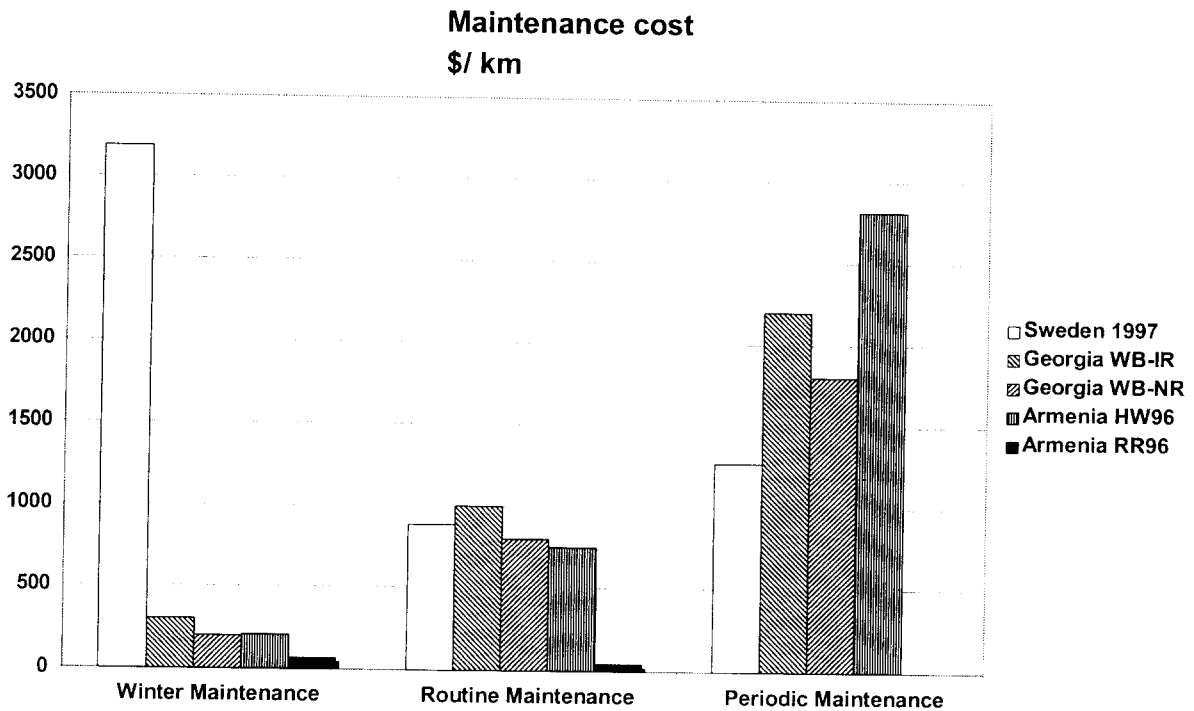
The seminar was run by Mr. Sven Odén from the Consultant, assisted by Mr Granberg and Mr. Griese.

6.1 Tender Documents

In seminar 5 there was no agreement about the tendering strategy. This gave some problem to make a Bill of Quantities. For this seminar it was assumed that the pilot area will comprise 170 km of highway and that it will be in one contract.

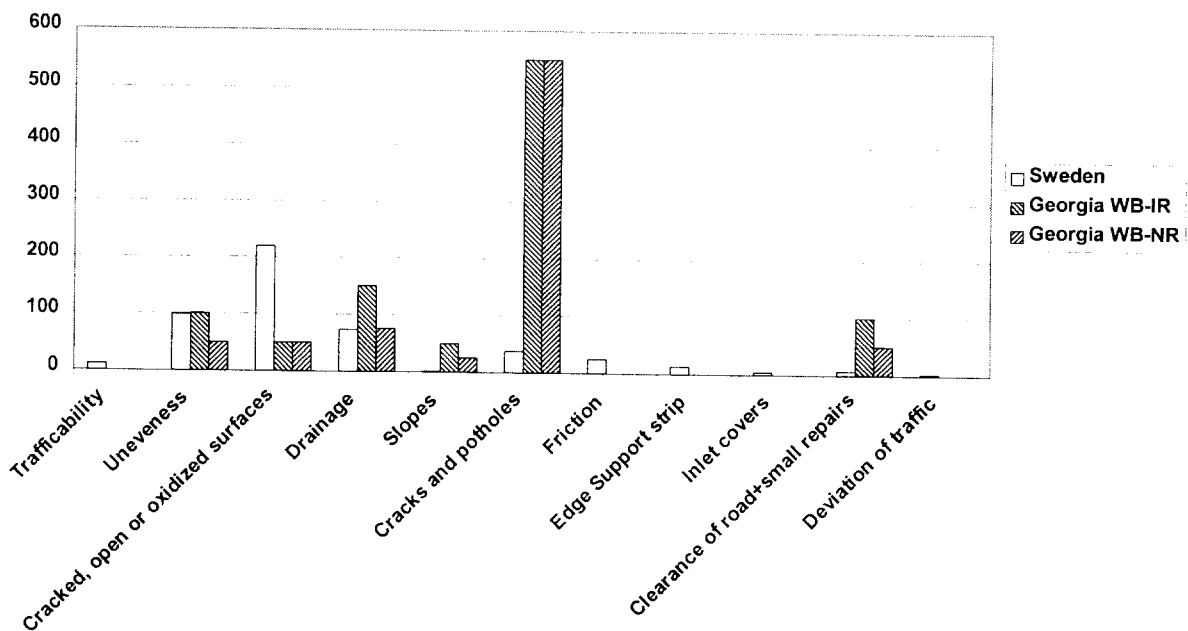
The funding of the pilot project has to be known before it is decided which standard/service levels to use and which maintenance activities to include.

14 Head of Enterprises participated in this seminar. The idea with a Pilot project for routine road maintenance by contract was repeated and the funding levels for routine maintenance and periodic maintenance were discussed based on a comparison between Sweden, a World Bank report from Georgia and the actual funds spent on the Armenian highways and republican roads 1996. The comparison showed that the funding for highways in Armenia was on an acceptable level if the roads are in a good condition. In the present situation, the funds are insufficient as most of the funds have to be spent on patching cracks and potholes. There was a complete lack of funding for republican roads in Armenia 1996.



A diagram showing the distribution of maintenance costs for paved roads pointed out the big difference between the contents of routine maintenance for well maintained roads and roads in poor condition. If the roads are well maintained, resources will preferably be spent more on preventive activities as sealing and cleaning ditches. The total cost will then be lower. This emphasises the importance of the ongoing program for reconstruction and rehabilitation of the highways in Armenia.

Routine maintenance of paved roads costs \$/km



The repair of cracks and potholes dominates the total cost when the road maintenance has been neglected for many years. As the pilot area for routine road maintenance by contract

mainly will comprise well maintained road (126 km and 44 km of road in poor condition), the question was raised, what will happen to all roads in poor condition if the standard requirements are upgraded in the pilot area. There is no simple answer to this. There is a conflict between preserving the upgraded road standard and to do emergency repair on roads in poor condition. But the question is very important as it underlines the importance of high efficiency in the repair work of Cracks and Potholes. An equipment especially designed for this kind of work and used in Sweden was demonstrated on a video.

The content of Bill of Quantities was briefly discussed. One important idea in routine maintenance by contract is that the contractor should have a great responsibility and that he should be free to find more efficient ways to achieve a desired standard. This means that the requirements for equipment and methods will be replaced by road standard requirements. At the same time the work has to be possible to calculate without putting an unacceptable risk on the contractor. It was proposed that standard requirements only (payed with a lumpsum) could be used on the well maintained road, while patching should be payed with unit prices for actual work on the road in poor condition.

6.2 Working paper on Quality Assurance

This Working Paper was presented and discussed at Seminar 6

The traditional method for controlling the Quality of Works in road (construction) contracts is through a special control organisation hired or tied to the Client. The following illustrates the situation.

6.2.1 Quality Control in the World Bank Standard Bidding Documents

The Conditions of Contract state about Control of Time, Quality and Costs. The following paragraphs dealing with quality of work are included in this document

33. **Identifying Defects** The Project Manager shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.
34. **Tests** If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.
35. **Correction of Defects** The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.
36. **Uncorrected Defects** If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

6.2.2 Quality Assurance Systems

A more efficient method than the above is to control the quality of work as an integrated part of the production. The requirements for such a Quality Assurance System are stated in EN-SS-ISO 9002. This has been widely accepted and practised. Such a system is demanded in the General Conditions for Maintenance by Contract in Sweden, from which the following is quoted to describe what it could look like.

General Conditions § AF2.35 Quality Assurance

The contractor should have a quality assurance system, which meets the requirements in EN-SS-ISO 9002. On request the system shall be presented to the client.

The management will appoint a person responsible for verifications in the project, who verifies the application of the quality system and the quality plan. The name of said person shall be announced.

Verifying will cover control, testing and supervision of planning, construction, production and maintenance activities included in the contract.

Verifying of planning and construction briefings and audits of the quality system/plan, processes and products shall be made by persons that are independent of those directly

responsible for the work done. It shall be proved that the quality system/plan is suitable and efficient for the actual work.

The application of the company's quality system/plan on the project shall be subject to internal quality audit.

The person who does the quality audit shall verify his competence through an accepted certificate from training in the technique of quality audit in accordance with SS-ISO-10 011. He shall have participated in at least two quality audits.

Schedule, routines and competence for verification and audit shall be presented in the tender.

The client is entitled to do quality audits at the contractor with respect to the contracted works. The contractor will guarantee the client this right in relation to sub-contractors, consultants and suppliers. The client's quality audit does not release the contractor's responsibility for his quality management.

The contractor will arrange special quality meeting with the personnel concerned, including sub-contractor personnel, on the work site at least once a month or when new personnel is arriving. The meetings shall be planned and held in agreement with the client. These meeting shall be documented.

Quality Plan

The quality plan shall contain at least the following.

- Quality objectives of the project
- Critical work components from a quality point of view
- Organisation, power and responsibilities of key personnel
- Routines for contract briefings
- Routines for construction briefing at total or function contract
- Routines for document management
- Routines for scrutinising suppliers
- Routines for marking, administration and tracing of material and documents
- Routines for process management
- Control programmes and control plans for self control (to be checked by the client)
- Routines for control and use of measuring and testing equipment
- Routines for handling deviations
- Routines for correcting actions
- Routines for management of quality documents
- Plan for continuous training in application of the company's quality system and the quality plan for the project.

Testing

Results from prescribed testing or measurement shall be presented to the client as soon as possible after the testing or measurement.

The contractor shall inform the client well in advance about the time for tests prescribed in the contract documents.

The contractor shall keep certificates from testing or measurements in the quality file, which shall be handed to the client at least two weeks before the handover inspection. Documents, which are not available at the time, shall be handed over to the client as soon as possible.

Quality assurance of work environment and work on trafficked roads

Plan for quality assurance of work environment and work on trafficked roads shall be presented in a quality plan. A control plan shall be produced.

Methods and routines for a safe traffic and work environment shall be presented in a quality plan or in traffic management plan (temporary traffic control)

Work environment and work on trafficked roads shall be an item on the agenda at project meetings. All personnel at the work site shall be informed and allowed to comment on traffic arrangements, protective clothing, etc. Before work commences the client shall be informed about the name of the person responsible for actions concerning work environment and work on trafficked roads.

Abnormal conditions

Plan for quality assurance of abnormal conditions shall be presented in the quality plan.

Verification

Not later than the 7th of the following month the contractor shall in a special report to the client assure the adherence with specific requirements, based on verifications. He shall present quantified deviations and describe actions taken or planned due to these deviations.

1.1.1 Discussion

Is the situation ripe for introduction of QA?

What level should control of routine maintenance be in the pilot project?

Part of the client organisation?

From the Institute?

Training needs for client and contractor

Appendix - Example of practical forms and procedures used

Verification

Quality plan for Maintenance Department Jonkoping	Date: 96-12-04	Version: 2	Page 1
Verification November			
Object maintenance Area Jonkoping			
Approved by: Kent Zerath	Checked by: P-O Dahlberg		

Verification of time schedule Inspection and measurement Appendices	Inspection (visual)	Measurement (inspection)	Signed	Appendix
0.2 Inspection of road	Road Inspector Weekly/biweekly			
831 Paved road 831.27 Friction	Road Inspector Monthly			
841 Road without snow and ice 841.22 Snow posts	Road Inspector Twice/year			
841.21 Transport of snow to dump		Road Inspector Biweekly		
843 Road free from obstacles 843.21 No obstacles in road	Road Inspector Weekly/biweekly			
851 Traffic safe surrounding area 851.21 Surrounding area	Road Inspector Monthly			
854 Traffic guidance 854.22 Side posts, reflecting gadgets on guard rail Reflection, contrast	Road Inspector Monthly			
855 Illumination 855.21 lamps etc.	Road Inspector Monthly			
856 Road side resting area 856.21 Service	Road Inspector Monthly			

Inspection procedures

Quality plan for Maintenance Department Jonkoping	Date:	Version:	Page
	Road Service Report Jonkoping West		
Object maintenance Area Jonkoping	Check List 0.2 a		
Approved by: Kent Zerath	Checked by: P-O Dahlberg		

In order to reveal deficiencies in road, road furniture or road area in relation to ordered standard, national roads should be inspected every week and other roads every second week. Minor deficiencies, like branches obscuring free sight, twisted road signs, debris on the travelled way, supplementing snow posts and guard posts should be corrected by the inspector in accordance to his instructions. Actions taken at the inspection are noted in the inspection form. Remaining deficiencies are noted and the responsible foreman is informed. During winter road winter condition is inspected. Actual traffic management plan and work environment requirement shall be observed.

Road Service Report

Maintenance area Jonkoping West						Name:	Year-month	
Week						Tel.:	Corrected/notified in checklist no.	Corrected date
Road no.	ate	No	ate	No	No	Notes		
E4						*		
R30						*		
R40						*		
R47						*		
185						*		
195						*		
609						*		
653						*		
683						*		
638								
640								
645								
846								

- National roads

Example of check list

Quality plan for Maintenance Department Jonkoping	Date: 96-11-11	Version: 2	Page 1
	Road Service Report Jonkoping West		
Object maintenance Area Jonkoping	Check List 853.25		
Approved by: Kent Zerath	Checked by: P-O Dahlberg		

Curb

Height of the curb over the road surface shall not be less than 60 mm and not more than 140 mm

Date	Road No.	Location	OK (sign)	Remarks

6.3 Working Paper – Evaluation of Bids

This Working Paper was presented and discussed at Seminar 6

It is not only the price that is important when competing bids are compared and evaluated. The bid should meet some minimum requirements to qualify for evaluation in the first place. These minimum requirements should be clearly spelled out in the tender documents. They would concern the contractor's experience, competence, resources, economic situation and if he has an acceptable approach to the project. If he has any reservation in his bid this should be analysed to find out if it disqualifies the bid. The bid should contain in a proper way all documents required in the tender documents.

In next step the acceptable bids are evaluated individually and in a third step compared with each other. There are a number of more or less sophisticated models available, but in the present case it is felt that a very simple model would serve the purpose best. The following factors should be analysed and evaluated.

1. **Plan of work.** The proposed approach to the project should be scrutinised, to make sure that the contractor has understood the project and that he has an efficient approach to it. In the case of the pilot project his approach to winter maintenance and pavement maintenance are of special importance.
2. **Resources.** The proposed set-up of plant and equipment should be well suited to the project. Composition, quality and number of different pieces of equipment should be evaluated.
3. **Experience.** The contractor should have sufficient previous experience of the type of work concerned.
4. **Competence.** The contractor should have competent (educated, trained and with documented ability) personnel, especially on key posts.
5. **Price.** The bid should be checked to make sure that all items asked for are included. Any reservations should be priced and added to the given price to arrive at comparable prices for all competing bids. The price should be analysed separately from the other evaluation in order to preserve objectivity.

The bids may be compared by means of a simple table as shown below. The price to compare can be adjusted (downwards) in relation to the number of surplus points gained.

Criteria	Bid A	Bid B	Bid C	Bid D
Minimum requirement met? (OK or -)				
Plan of work (surplus value if any, 0-3p)				
Resources (surplus value if any, 0-2p)				
Experience (surplus value if any, 0-2p)				
Competence (surplus value if any, 0-2p)				
Price (adjusted for any reservations)				
Adjusted price to compare				

Seminar 7 – Summary and findings

Date: 28 November 1997.

The purpose of Seminar 7 was to summarise the project and present findings and proposals, which could fit into the Final Report.

Participants:

Karchikian P.	Deputy Director of ARD
Elarian N.	Head of PIU
Akopian S.	Coordinator PIU
Badalian K.	Engineer PIU
Badalian. J	Head of ARD dept.
Kazarian P.	Head of ARD dept.
Marcosian R.	Coordinator ARD
Petrosian A.	Coordinator PIU
Shikanian A.	Deputy head of ARD dept.
Srapian R.	Head of ARD dept.

Mr. Frank Granberg, assisted by Mr. Sven Odén and Mr Kurt Ahrling from the Consultant led the seminar

The presentation and the discussions in the seminar was organised in five parts:

- **Previous Seminars**
- **Problems - Possibilities**
- **Pilot Project**
- **Training**
- **“Home Work”**

Previous Seminars were summarised very briefly and the main points were repeated. A discussion with comments and question followed. The seminar commented on were the following

- Seminar 1- A vision of the future
- Seminar 2 - Pilot Project Area
- Seminar 3 - Goals and Strategies
- Seminar 5 - Tendering Strategy
- Seminar 6 – Tendering

The part “Problems – Possibilities” dealt with the Consultants findings regarding crucial factors for an efficient routine maintenance. The factors, which were discussed, were:

- Financing. Unless road maintenance gets satisfactory financing there is not very much hope for an improved routine maintenance and an improved road standard. Legislation for the creation of a Road Fund and related facilities is planned to be

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The part “Problems – Possibilities” dealt with the Consultants findings regarding crucial factors for an efficient routine maintenance. The factors, which were discussed, were:

- **Financing.** Unless road maintenance gets satisfactory financing there is not very much hope for an improved routine maintenance and an improved road standard. Legislation for the creation of a Road Fund and related facilities is planned to be

passed in Parliament in December this year. This means that a reliable source of finance will be established within a foreseeable future.

- Efficiency - Equipment - Work methods. It has been easy to find that the present efficiency in maintenance production has a great improvement potential. Better and reliable equipment in combination with efficient work methods may roughly result in a 100% increase in productivity. As an example a video on a Swedish piece of patching equipment was referred to. In previous seminar costs and out put in the Armenian road sector was compared with figures from other countries. The comparison illustrated the need for improvement. This applies mainly to the enterprises, private and government owned, which presently are heavily over-staffed and ill equipped. The Consultants views were supported by the following discussion.
- Competition in a Market. This is a relatively new phenomenon, which might require some changes of attitudes and alertness to support the creation and preservation of a market. With time and some training activities this was considered by the audience to be solved in a satisfactory way.
- Management - General - Quality Assurance. The consultant felt that there is a need for support in the development of both the Supplier and the Client organisation by means of management training. Also there is a need for management tools like information systems of which Quality Assurance was mentioned as one example. The audience supported the ideas presented.

The available data about the Pilot Project was presented in outline and discussed. The choice of Pilot Area was scrutinised. It was stressed by the consultant that a definitive decision has to be reached in time for the next phase with the concrete preparation for tender. The content of the Final Report with respect to Contract Documents was outlined. The requirements for a fruitful Pilot Study were discussed. The roles Client – Supplier were stressed and the need for conditions supporting competition in tendering.

From the previous discussion resulting Training needs were discussed and summarised. A proposal containing the Swedish “Trunk Patcher” for mending potholes, could be an effective illustration to the rationalisation potential. Training of trainers for Rationalisation Engineers could be a very feasible way of introducing new thinking and attitudes. The idea of including a proposal on management training in the consultant's report was supported.

In the part labelled “Home Work” the consultants summarised what they felt was required from the ARD and PIU as a prerequisite for the continued project.

- First of all the Finance situation has to be sorted out and solved.
- Secondly the philosophy regarding Vision - Goals - Priorities – Standards was recommended as a method to harmonise the standards for routine maintenance with governing parameters like budget restrictions and other limiting factors.
- Tender Documents will be presented in the Final Report but they have to be processed by the ARD with additions and adjustments to be useful in the next phase of the project

APPENDIX B – ADJUSTMENT OF PMS

TRACECA - Technical Assistance to the Armenian Road Directorate
Pavement Management System - Adjustment to local condition



Repair Products

No.	Repair product	Description (Maintenance activity)	Used for	Price (dependence on quantity)		Service life (dependence on traffic) from - to ESAL	Road Class	Usage District
				Quantity from - to	Unit US \$			
	<u>Routine Maintenance</u>							
1	RM Seal	Seal cracks	Cracks	0 - 99,999,999	m	0 - 9,999,999	all	all
2	RM Resealing	Superficial treatment, Resealing of the affected area	Alligator cracks Ravelling	0 - 99,999,999	m ²	0 - 9,999,999	all	all
3	RM Patching	Cut away to obtain a patch with straight edges; fill with bituminous material and compact	Potholes	0 - 99,999,999	m ²	0 - 9,999,999	all	all
4	RM Replacement	Replace bituminous layer by material of better composition	Rutting Bleeding	0 - 99,999,999	m ²	0 - 9,999,999	all	all
5	RM New Pavement	Remove the material in the affected area; replace by new base or subbase material and compact properly; reinstate the surface course	Settlements	0 - 99,999,999	m ²	0 - 20,000,000	all	all
6	RM Spread Chippings	Spread chippings on the affected area	Bleeding	0 - 99,999,999	m ²	0 - 9,999,999	all	all
	<u>Repair</u>							
7	Seal	Seal cracks before Periodic Maintenance	Cracks	0 - 99,999,999	m	0 - 9,999,999	all	all
8	Patching	Patch potholes and settlements before Periodic Maintenance	Potholes Settlements	0 - 99,999,999	m ²	0 - 9,999,999	all	all
9	Milling + Patching	Milling and patchings of rutting before Periodic Maintenance	Rutting	0 - 99,999,999	m ²	0 - 9,999,999	all	all

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No.	Traffic from - to ESA	Speed km	Pavement type	Damage	Usage Condition			Usage			Remarks
					min %	max %	min year	max year	Only RM		
1	0 - 30,000,000	0 - 200	Asphalt	Cracks	0	30	0	30	yes		
2	0 - 30,000,000	0 - 200	Asphalt	Alligator cracks Ravelling	0	50	0	30	yes		
3	0 - 30,000,000	0 - 200	Asphalt	Potholes	0	30	0	30	yes		
4	0 - 30,000,000	0 - 200	Asphalt	Rutting	0	50	0	30	yes	Unit price Milling = 7780 Dram/m³	
5	0 - 30,000,000	0 - 200	Asphalt	Bleeding Settlements	50	100	0	30	yes		
6	0 - 30,000,000	0 - 200	Asphalt	Bleeding	0	50	0	30	yes		
7	0 - 30,000,000	0 - 200	Asphalt	Cracks	0	100	0	30	no		
8	0 - 30,000,000	0 - 200	Asphalt	Potholes Settlements	0	100	0	30	no		
9	0 - 30,000,000	0 - 200	Asphalt	Rutting	0	100	0	30	no	Unit price = costs of milling + patching	

TRACECA - Technical Assistance to the Armenian Road Directorate
Pavement Management System - Adjustment to local condition



Pavement Products

No.	Product	Thickness mm	Price (dependence on quantity)		Service life (dependence on traffic)		Road Class	Usage		Speed km	Usage Used for Pavement type	reduce IRI max %	IRI lowest obtainable
			Quantity from - to	Unit US \$	from - to ESAL	years		District	Traffic from - to ESA				
1	Surface Dressing	200	99,999,999	m ²	0.74	0 - 9,999,999	6	all	all	0 - 200	Asphalt	15	4.0
2	Surface Dressing + Levelling Course 40 % of the area	500	99,999,999	m ²	1.71	0 - 9,999,999	6	all	all	0 - 200	Asphalt	20	4.0
3	Surface Dressing + Levelling Course 100 % of the area	500	99,999,999	m ²	3.17	0 - 9,999,999	6	all	all	0 - 200	Asphalt	30	4.0
4	Overlay 50	50	99,999,999	m ²	4.05	0 - 9,999,999	7	all	all	0 - 200	Asphalt	65	3.5
5	Overlay 70	80	99,999,999	m ²	5.67	0 - 9,999,999	7	all	all	0 - 200	Asphalt	80	3.5
6	Overlay 110	100	99,999,999	m ²	8.91	0 - 9,999,999	7	all	all	0 - 200	Asphalt	100	3.0
7	Reconstruction	380	99,999,999	m ²	20.00	0 - 20,000,000	15	all	all	0 - 200	Asphalt	100	2.5

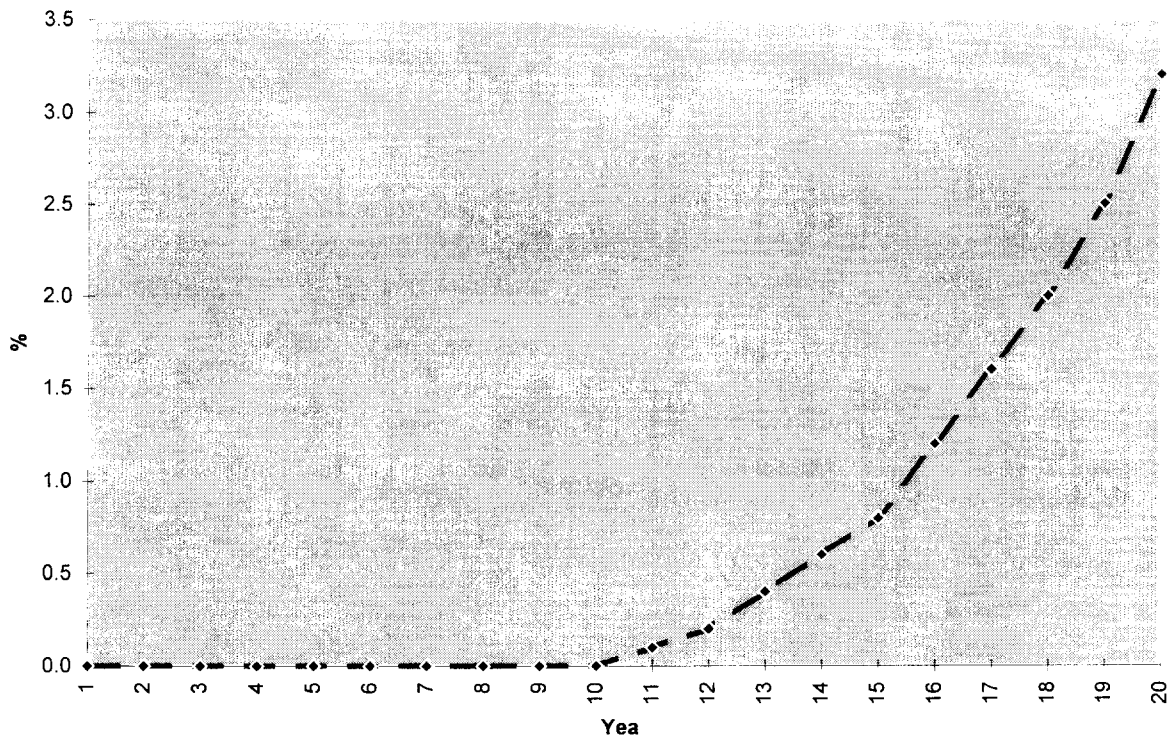
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No.	Damage		Usage Condition		Prior repair	No of pavings max consecutive	Surfacing		Used for	Description of the produkt		Reinforcement property (%)
	min %	max %	min year	max year			indicate years for covering in relation to traffic from ESA	to ESA		Volume (kg/m ²)	E-modul (MPa)	
1	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	30 50 30 30 50 100 100	3 30	30	10			Wearing course	22.5	2000	0
2	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	30 50 30 30 50 100 100	3 30	30	8			Wearing course	22.5	2000	0
3	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	30 50 30 30 50 100 100	3 30	30	8			Wearing course	22.5	2000	75
4	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	100 100 100 100 100 100 100	0 30	30	6			Wearing course	22.5	2000	100
5	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	100 100 100 100 100 100 100	0 30	30	4			Wearing course	22.5	2000	100
6	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	0 0 0 0 0 0 0	100 100 100 100 100 100 100	0 30	30	3			Wearing course	22.5	2000	100
7	Cracks Alligator cracks Potholes Settlements Rutting Ravelling Bleeding	30 50 30 30 50 0 0	100 100 100 100 100 100 100	0 30	30				Wearing course Binder Bound base Unbound base subbase	22.5	2000	100

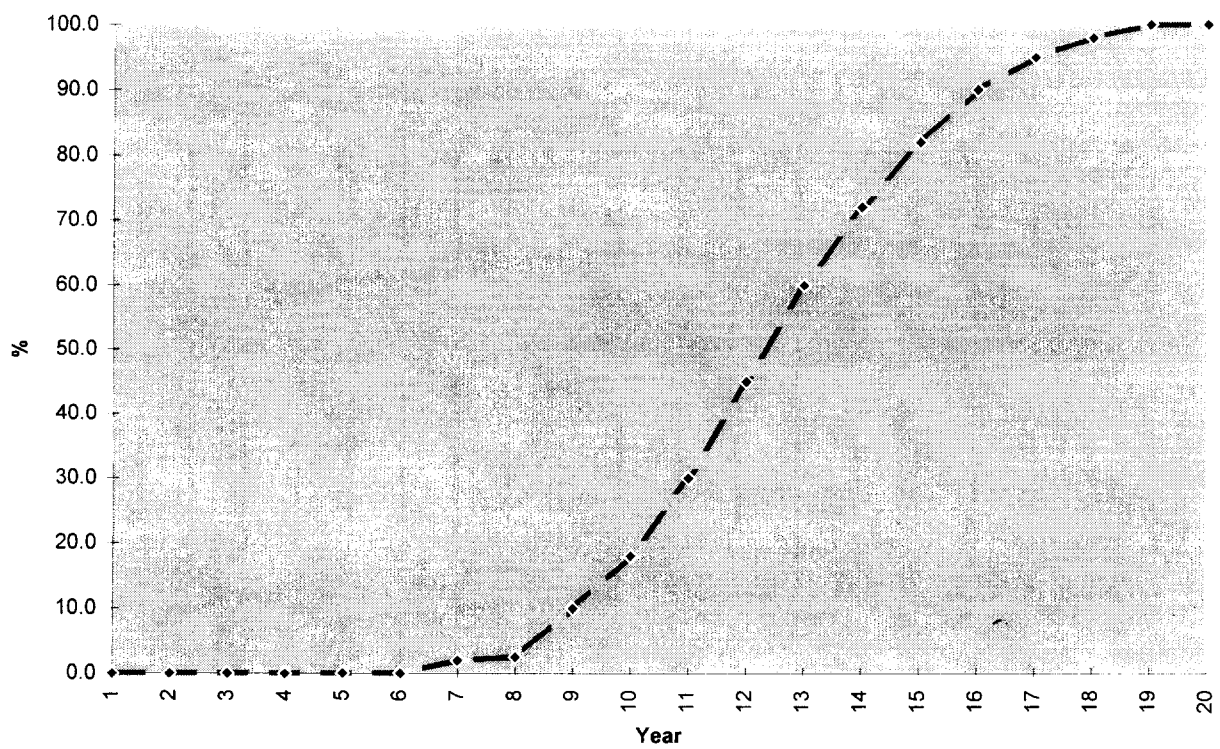
Deterioration model: Potholes

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Area of potholes (%)																					
New Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.6	0.8	1.2	1.6	2.0	2.5	3.2	



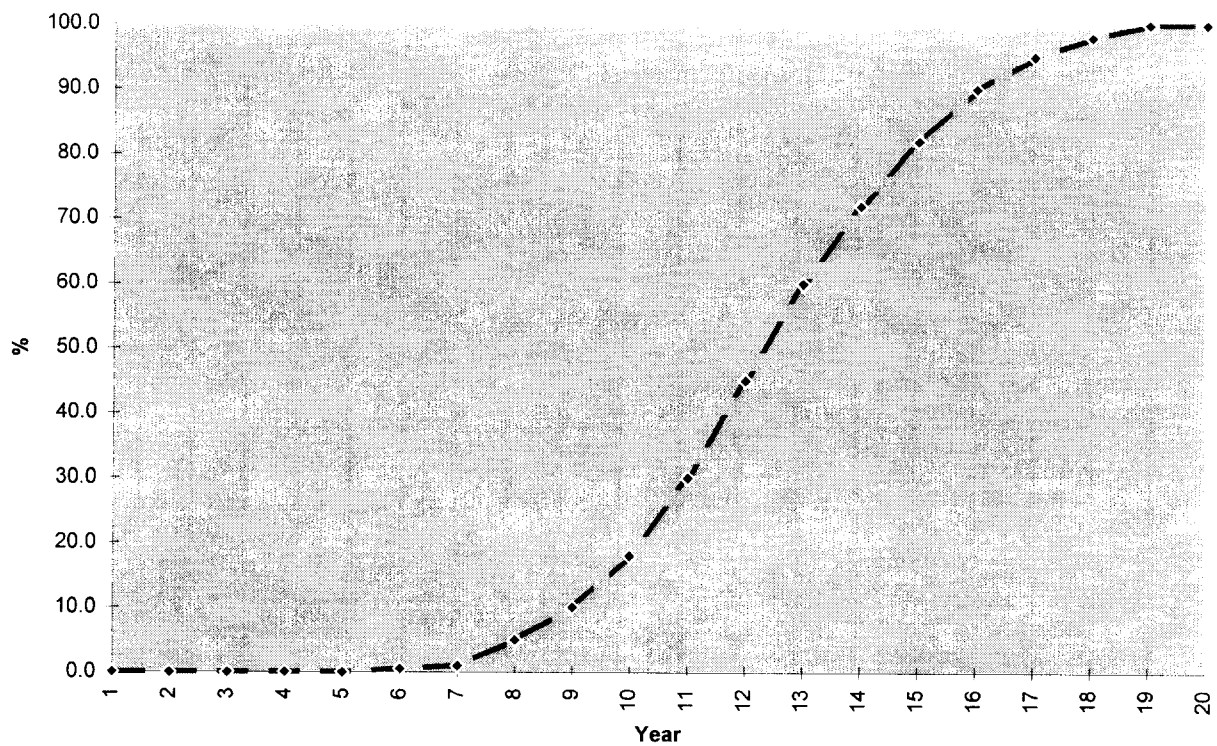
Deterioration model: Cracks

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Area of cracks (%)																					
New Value	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.5	10.0	18.0	30.0	45.0	60.0	72.0	82.0	90.0	95.0	98.0	100.0	100.0	



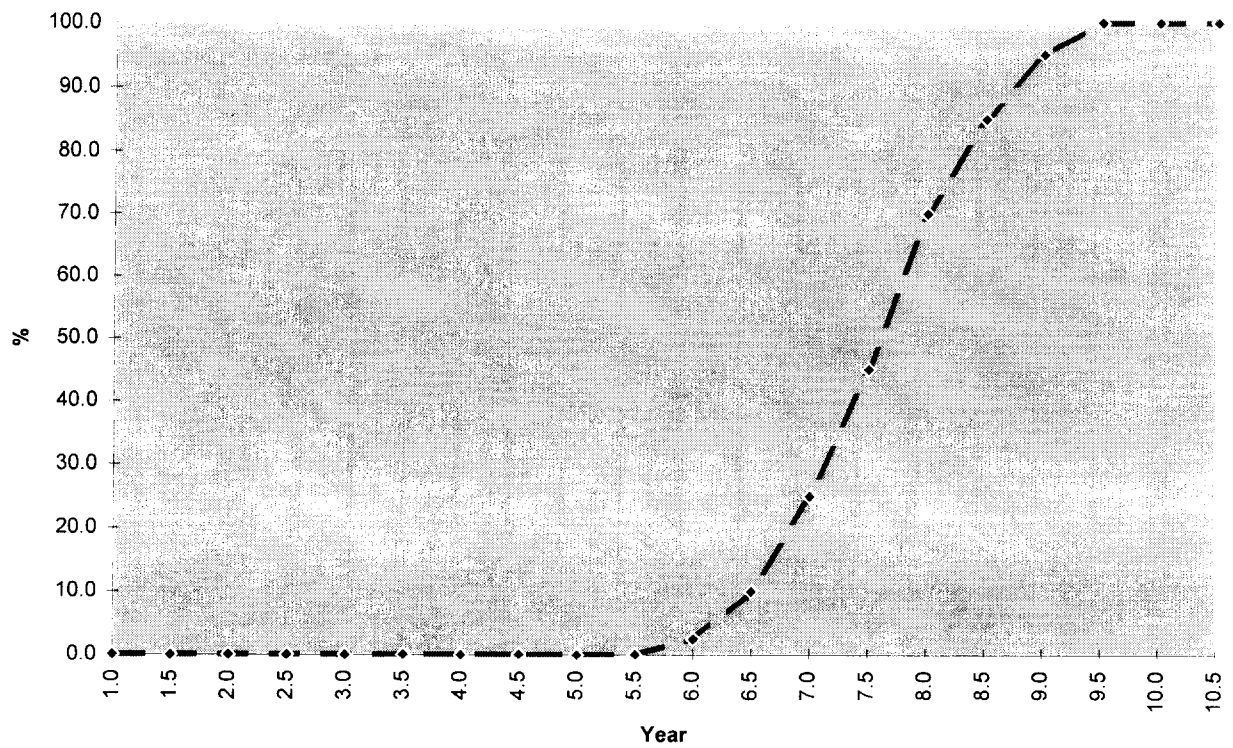
Deterioration model: Alligator Cracks

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Area of Alligator cracks (%) New Value	0.0	0.0	0.0	0.0	0.0	0.5	1.0	5.0	10.0	18.0	30.0	45.0	60.0	72.0	82.0	90.0	95.0	98.0	100.0	100.0



Deterioration model: Ravelling

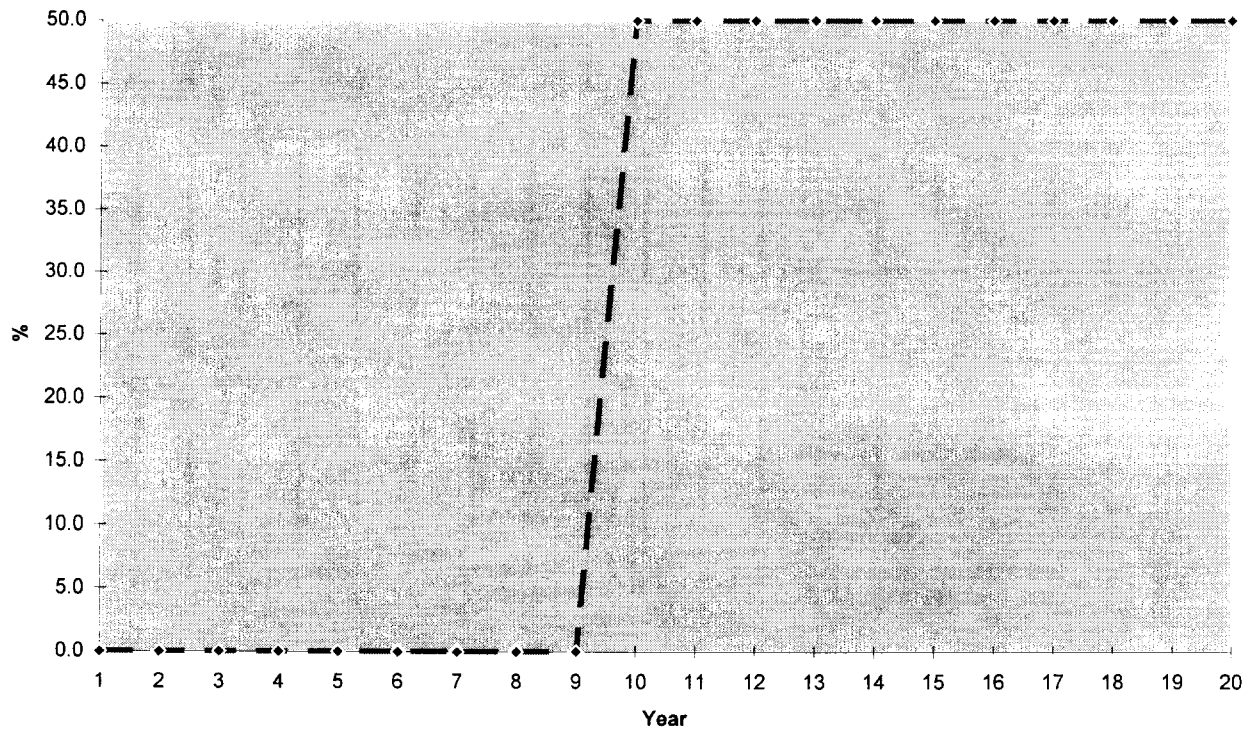
Year	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	
Area of Ravelling (%)																					
New Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	10.0	25.0	45.0	70.0	85.0	95.0	100.0	100.0	100.0	



Deterioration model: Rutting

Pavementage (years)	0	2	4	6	8	10	12	14	16	18	20
Ruth depth mean (mm)	0.0	8.5	10.5	12.0	13.5	16.0	17.0	17.5	18.0	19.0	20.0
Ruth depth standard deviation (mm)	0.0	3.5	4.0	4.2	4.5	4.8	5.0	5.1	5.2	5.3	5.5

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Area of Rutting (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
New Value																				



APPENDIX C – PEOPLE MET AND MEETINGS HELD

Date	Subject	People met	
20/9	General information	Mr. Papik Kartshikyan, Mr. Nikolay Elarian Mr. Hakob Petrosyan	First Deputy Chairman of ARD Director of PIU Project Coordinator
22/9	Project programme, winter maintenance	Mr. Papik Kartshikyan, Mr. Hakob Petrosyan Mr. Roudolf Atabegyan	First Deputy Chairman of ARD Project Coordinator Head Consultant
23/9, 24/9	Project Discussions	Mr. Hakob Petrosyan	Project Coordinator
25/9	Project programme	Mr. Nikolay Elarian Mr. Hakob Petrosyan Mr. Anders Bonde Mr. Robert Nooter	Director of PIU Project Coordinator WB Task manager WB Consultant
	Plant Pool	Mr. Hamlet Karapetyan Mr. Hakob Petrosyan Mr. Zohrab Petrossyan	Director of Plant Pool Project Coordinator Head of Sevan Enterprise
26/9	Inspection field tour Yerevan – <u>Guimry- Spitak</u>	Mr. Hakob Petrosyan Mr. Robert Sukiasyan.	Project Coordinator Chief Engineer, Guimry Construction Enterprise
27/9	Meeting with Finnroad, Supervisors on Armenia Highway Project	Mr. Aimo Aaltonen Mr. Vytatas Vilutis	Team leader Supervision Engineer
28/9	Sunday		
29/9	Meeting with WB Delegation	Mr. Anders Bonde Mr. Robert Nooter	Head of Mission Assistant
30/9	Visit to TRACECA Office at MoFE	Business Card and Basic Project Data left at office	
1/10	Visit to Seminar on RUC and Road Fund at the American University. Seminar led by the Hon. Minister of Works, Mr. H. Kochinyan. Mr. Ian Heggie, WB, Mr. H. Millner, Latvian Road Fund were key lecturers.		
2/10	Planning of Seminar 1	Mr. Hakob Petrosyan Mr. Papik Kartshikyan,	Project Coordinator First Deputy Chairman of ARD
3/10	Seminar 1 - Privatisation	Introduction to Maintenance by Contract, Client/supplier roles, Organisation (Mr. Papik Kartshikyan, Mr. Hakob Petrosyan and 8 other participants) ¹⁾	
3/10	Meeting with TACIS Representatives	Mr. Khachatur Manukyan	Local Expert, Assistant

6/10	Inventory work, Bridges	Badalian Karen	ARD
8/10	Danish presentation	Carsten Wass	Road Directorate Denmark
8/10	Seminar 2	Information about Pilot Project and Pilot Project Area ¹⁾	
8/10	Discussion about Bidding documents	R. Srapian S. Hakobyan	ARD PIU
10/10	Inspection tour to Vaik, Goris	Georgian Karo Voskanian Nelson	Chief enterprise Vaik " Goris
11/10	Inspection tour to Kapan	Arjapetian Levon	" Kapan
14/10	Meeting with TACIS – TRACECA representatives	Anthony Murphy Ted Bishop	Module A TACIS -TRACECA . Connect FINNROAD-PARKMAN-ROUGHTON-PHOENIX PROJECT
15/10	FINNRA	Tapio Raukola	Traceca project Road Maintenance Winter Module B
16/10	PARKMAN	Kimo Karini	Bridge training. Earlier cooperate with Mr. Carsten Griese
21/10	Inspection tour to Martuni	Poghossyan Vahagn	Chief of "private enterprises"
22/10	Inspection tour to Vanadzor, Spitak	Darbinyan Samvel Arsen	Chief of "private enterprises" "
12/11	Presentation of "Trunk Repair" equipment	Mr. N. Elarian	Director of PIU
14/11, 19/11 resp.	Exchange of information	Mr. K. Davis Mr. J.E. Pincock	Parkman, Consult on bridge maintenance
16/11	Study tour to Garni (East of Yerevan)		
17/11	Project Discussions	Mr. N. Elarian Mr. Hakob Petrosyan	Director of PIU Project Coordinator
18/11	Project Discussions	Mr. Papik Kartshikyan Mr. K. Badalian	First Deputy Chairman of ARD Engineer PIU
	Visit to Institute	Mr. Samvel Badalian	Director
20/11	Seminar 3 – Goals and Strategies	Mr. Papik Kartshikyan ¹⁾	First Deputy Chairman of ARD
21/11	Seminar 4 – Maintenance Standards	Mr. N. Elarian ¹⁾	Director of PIU
25/11	Meeting about Bidding Documents	Mr. Hakob Petrosyan Mr. S. Hakobyan Mr. R. Srapian	Project Coordinator Design Preparation Coordinator Head of Department, ARD

25/11	Seminar 5 – Tendering Strategy	Mr. Papik Kartshikyan Mr. N. Elarian ⁾	First Deputy Chairman of ARD Director of PIU
27/11	Seminar 6 – Tender Documents, Bid evaluation, QA	Mr. Papik Kartshikyan Mr. N. Elarian ⁾	First Deputy Chairman of ARD Director of PIU
28/11	Seminar 7 - Summary and findings	Mr. Papik Kartshikyan Mr. N. Elarian ⁾	First Deputy Chairman of ARD
29/11	Study tour to Pilot Area		
2/12	Project Discussions	Mr. Papik Kartshikyan Mr. Hakob Petrosyan	First Deputy Chairman of ARD Project Coordinator
5/12	Summary of reporting	Mr. N. Elarian	Director of PIU
⁾ Other participants, see notes from seminar			

