EUROPEAN UNION - TACIS

Technical Assistance to the Southern Republics of the CIS

and Georgia - TRACECA

TRADE AND TRANSPORT SECTORS

IMPLEMENTATION OF PAVEMENT MANAGEMENT SYSTEMS

PROJECT NO.: TELREG 9305

FEASIBILITY STUDY FOR REHABILITATION OF TRANSIT ROADS IN GEORGIA

INCEPTION REPORT

March 1997

KOCKS CONSULT GMBH
Consulting Engineers
Koblenz / Germany

in association with

TECNECON, Economic
and Transport Consultants
London / U. K.

PHØNIX
Pavement Consultants
Vejen / Denmark

KOCKS CONSULT GMBH KOCKS INGENIEURE

Kocks Consult GmbH · P. O. Box 10 60 · 56010 Koblenz FRG

Head Office Koblenz
Stegemannstraße 32 - 38
56068 Koblenz

Phone xx (49 261) 13 02-0
Telefax xx (49 261) 13 02-15 2
Cable KOCON

European Bank for Reconstruction
and Development - EBRD
Attn. Mr. Christopher Ousey
One Exchange Square
London EC2A 2EH

UNITED KINGDOM

Ref.
243/Wei-ns/2293

Koblenz
11.04.1997

Dear Sir,

TRACECA Project: Implementation of Pavement Management Systems
Project Number: TELREG 9305
Feasibility Study for Rehabilitation of Transit Roads in Georgia

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We take pleasure in submitting to you the inception report of the above project for your review and comment.

According to the Terms of Reference the report is submitted in three copies. Complementary copies are forwarded to the European Commission (DG IA) in Brussels and the Tacis Coordinating Unit in Tbilisi. By e-mail a copy was forwarded to the Tacis Monitoring & Evaluation Central Asia in Almaty and to the Monitoring Unit in Kiev.

The Russian version is presently under translation and will be submitted as soon as possible.

Yours faithfully

KOCKS CONSULT GMBH
Consulting Engineers

Werner P. Weiler

Copies to: The EC, DG IA, Brussels (Attn. Mr. D. Stroobants)
Tacis CU in Tbilisi

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COVER PAGE
INCEPTION REPORT (FS - GE)

REPORT COVER PAGE

Project Title	:	Traceca Project - Implementation of Pavement Management Systems Addendum No. 1, Component 1, Module A: **Feasibility Study for Rehabilitation of Transit Roads in Georgia**
Project Number	:	TELREG 9305
Country	:	Georgia

		Local Operator	EC Consultant
Name	:	State Concern of Roads, **SAKAVTOGSA**	KOCKS CONSULT GMBH Consulting Engineers
Address	:	29a Gagarin Street 380060 Tbilisi GEORGIA	Stegemannstraße 32 - 38 56068 Koblenz GERMANY
Tel. Number	:	(99532) 370666	xx49 - 261 - 1302-0 (operat.) xx49 - 261 - 1302-143 (direct)
Fax number	:	(99532) 376458	xx49 - 261 - 1302 - 152
Telex number	:	212189	862807
E-mail	:	--	kocks@t-online.de
Contact person	:	Tamaz A. Shilakadze, Vice chairman of the State Concern SAKAVTOGZA and Director of the Institute SAKGZAMETSNIEREBA	Werner P. Weiler
Signatures	:		

Date of report : 04.04.1997

Reporting period : 30.01.1997 - 31.03.1997

Author of report: Carsten Griese, Senior Highway Engineer (Kocks Consult GmbH)

EC M & E Team	(name)	(signature)	(date)
EC Delegation	(name)	(signature)	(date)
TACIS Bureau (Task Manager)	(name)	(signature)	(date)

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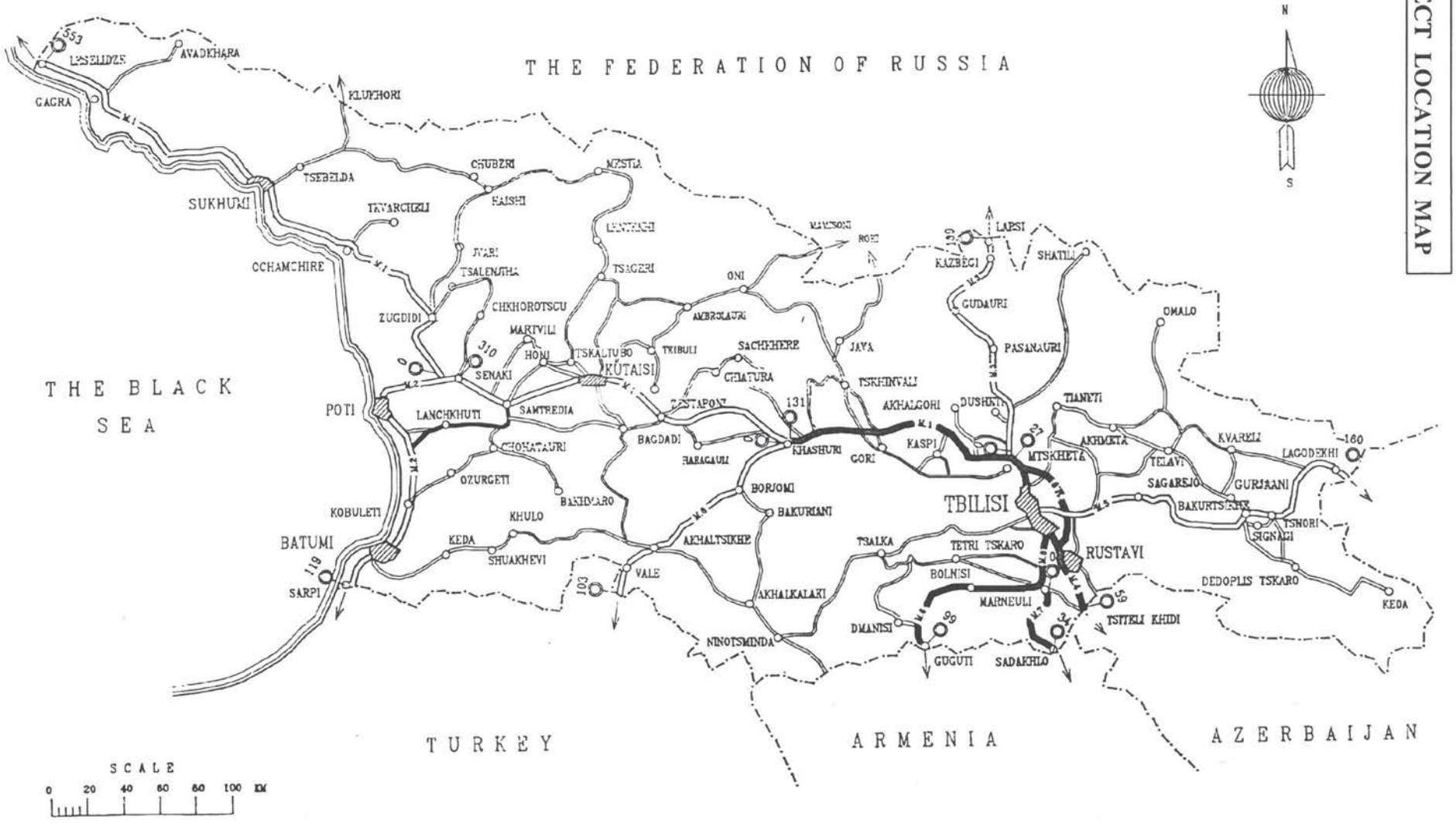
APPENDIX

THE NETWORK OF HIGHWAYS OF THE REPUBLIC OF GEORGIA

PROJECT LOCATION MAP



1. PROJECT SYNOPSIS

Project Title	:	Traceca Project - Implementation of Pavement Management Systems Addendum No. 1, Component 1: **Feasibility study for rehabilitation of transit roads in Georgia**
Project Number	:	TELREG 9305
Country	:	Georgia

Project objective[s]:

The objective of the Project is to prepare a feasibility study for rehabilitation works on the road sections
Tbilisi - Kashuri
Tbilisi - Taltari - Azerbaijan border
Tbilisi - Marneuli - Guguti - Armenian border
Marneuli - Sadakhlo - Armenian border
Tbilisi - bypass
Samtrelia - Lanchkuti - Ureki (shortening the route Tbilisi - Batoumi)
for definitive negotiations between Georgia and International Financing Institutions.
This objective will be achieved principally by the following main components:

- review of existing reports
- preliminary definition of the improvement and rehabilitation works
- quantity calculation and cost estimate for the proposed works
- economic evaluations for financing and prioritization of the road section

The local personnel will be involved in the project tasks and trained in the practice for road survey and evaluation methods.

Planned outputs :

- mobilization and commencement of services
- study of existing reports and available road and bridge data
- field works and data collection of road surface/pavement and bridge condition
- geotechnical investigation
- assessment of traffic demand
- definitions of technical solutions for improvements and rehabilitation
- economic evaluation

Project activities since start :

- project preparation
- mobilization of Consultant's staff and equipment
- commencement meetings with the TACIS CU and the recipient institute
- arrangement of logistics (accommodation, office, transport)
- preparation of contract for cooperation
- commencement of field works (collection of road surface/pavement and bridge condition data)

Project starting date: Actual start of project activities on 30.01.1997

Project duration : 6 months

2. ANALYSIS OF PROJECT

2.1 Start of Project

Project activities in Georgia commenced with the arrival of the Consultant's staff in Tbilisi on 30.01.97.

The first activities included the arrangement of the logistics for the project (accommodation, office, transportation etc.). Commencement meetings concerning co-operation with the local counterpart, State Concern Sakavtogza, were held and the Scientific Research Institute Sakgzametsniereba of the State Concern Sakavtogza has been determined as the counterpart for technical co-operation.

The activities for the field works for the feasibility study commenced after the preparation phase including road surface/pavement and bridge condition survey. After the initial introduction of equipment and working method all activities are carried out by the Consultant's staff together with specialists of Sakavtogza as an on-the-job-training and transfer of technology.

Through the cold winter weather in Georgia with periods of frost and snow the field investigation again and again had to be interrupted. This effectively prevented the field investigation to continue until the winter conditions were over.

During the second week in February the consultants were informed by Sakavtogza that discussions between TACIS and Sakavtogza were held for the road between Kashuri and Samtredia to be added to the list of roads to be studied. The road between Marneuli and Sadakhlo on the Armenian border was also partly removed from the list of roads to be studied. In a meeting between TACIS and Sakavtogza in the beginning of March it was decided, that no deviation from the Terms of Reference shall be made.

2.2 Main Problems and Deficiencies

The road sections Kashuri - Tbilisi - Azerbaijan border and Samtredia - Ureki are part of an east - west corridor linking the Caucasus and Central Asia with the Black Sea and are of high importance for international heavy vehicle traffic.

As a result of pavement construction, lack of equipment and quality control together with deficiencies in road maintenance the condition of the road is deteriorating.

The recent inspection of the project roads showed that many of the sections are in a poor or poor to bad condition. The road surface shows severe deformations, potholes, cracks, which form considerable danger to road users especially for passenger cars. In several sections the pavement is completely destroyed.

3. PROJECT PLANNING

3.1 Relation with other Projects

The Feasibility study for rehabilitation of transit roads in Georgia is part of the TRACECA Project (Transport Corridor Europe - Caucasus - Central Asia). In 1996 under the same project the Pavement and Bridge Management System (PMS & BMS) were introduced, which will be utilised for this project.

TACIS intends to finance the rehabilitation and reconstruction of the red bridge. The red bridge is an existing masonry arch bridge which is on or very close to the border between Azerbaijan and Georgia. The feasibility study will take into consideration this project.

The traffic forecast will incorporate the traffic forecasts being prepared by W.S. Atkins International in the context of the TRACECA Regional Database and Forecasting Model, when it is available.

3.2 Project Objectives

The objective of the project is to prepare a feasibility study for the rehabilitation works for define negotiations between Georgia and International Financing Institutions on the following road sections:

- Tbilisi - Kashuri
- Tbilisi - Taltari - Azerbaijan border
- Tbilisi - Marneuli - Guguti - Armenian border
- Marneuli - Sadakhlo - Armenian border
- Tbilisi - bypass
- Samtrelia - Lanchkuti - Ureki (shortening the route Tbilisi - Batoumi)

This objective will be achieved principally by
(i) review existing reports
(ii) preliminary definition of the improvement and rehabilitation works
(iii) quantity calculation and cost estimate for the proposed works
(iv) economic evaluation

3.3 Project Approach

Collection of Data

Existing reports and documents have already been studied and literature review of published data concerning the project area was carried out.

The above mentioned joint site/road inspection confirmed that the alignment for the road improvement will follow the existing road.

The first project phase is a comprehensive investigation of the existing situation required to undertake the feasibility study and to prepare the data for the appraisal by HDM method including:

- road/pavement condition survey
- bridge condition survey
- traffic survey
- geotechnical investigation

Road Inventory

The data and information about the road will be reviewed and updated during the field works. The road inventory comprised the data collection for:

- road and shoulder width
- rise and fall
- roughness

- condition (cracking, potholes, rutting)
- pavement strenght

Bridge

The inspection of the structures and the recording of their condition will be carried out as a visual inspection. All essential details from the available bridge records will be checked and visible deviations will be documented. The focus of the inspection will be on accessible parts of the structure. Nevertheless the results will be generally representative.

For the assessment of the bridge condition a special rating system was developed (see Appendix 2). On the basis of this system the condition of the many structural units will be described with the help of marks of condition. These marks are influenced both by the amount of the damage and by the importance of the damage for the bearing capacity and durability of the structure.

At the judgement of the buildings and the specification of the necessary works also the results of the traffic analysis will be taken into account. In the result of this analysis the requirements for the cross section will be defined.

At the work for the technical solutions for the rehabilitation the valid standards and regulations of the country will be used. A principle technical solution for each kind of damage will be worked out which will be used for every structure and for each of this technical solutions a unit price will be investigated.

Drainage Inventory

The culverts will be inspected and records are taken for:

- geometrical data (length, diameter etc.)
- material of culverts (concrete, metal etc.)
- type of culvert (pipe, box etc.)
- condition of culvert (damaged, broken, silted etc.)

Geotechnical Investigation

Basic input data for computation of design life and required strengthening, and type and thickness of the existing structural layers as well as natural subgrade will be investigated. Type and density of higher embankment fills and subgrade at greater depths will be investigated by small diameter percussion borings and dynamic percussion borings and dynamic cone penetrometer (DCP) tests.

Traffic Surveys

Work on planning the traffic surveys required for the estimation of base year traffic commenced with the arrival of the Senior Transport Economist and Transport Planner in Tbilisi on 8 February 1997. Planning of traffic surveys in Georgia commenced on the assumption that the roads to be studied would be those listed in the Terms of Reference, namely:
Tbilisi - Kashuri
Tbilisi - Taltari - Azerbaijan border
Tbilisi - Marneuli - Bolnisi - Guguti (Armenian border)
Marneuli - Sadakhlo (Armenian border)
Tbilisi bypass
Samtredia - Lanchkhuti - Ureki

A programme of classified volume counts at 11 locations on these roads was accordingly drawn up.
In planning the necessary classified volume counts, reference was made to the earlier classified volume counts undertaken for the Consultants in September 1996 as part of the TRACECA Pavement Management System project. These counts were carried out by Sakavtogsa staff on the following roads:
Tbilisi - Marneuli (Km 18)
Tbilisi - Tsiteli Khidi - Azerbaijan border (Km 10)
Tbilisi - Kashuri (Km 25)

The results of other traffic counts undertaken by Sakavtogsa on the main road network during 1995/96 were also evaluated as part of the planning process.

The vehicle classification being used in the traffic surveys is consistent with that being used in other parts of the feasibility study, notably in the traffic forecasts, the analysis of road user costs and axle load and pavement damage analyses.

It may also be necessary to undertake some sample roadside interviews of car and bus passengers to establish journey purpose information as a basis for estimating passenger time values.

The basic survey form which will be used in the classified volume counts to be carried out in Georgia is attached in Annex 1.

Axle Loads

The Consultants carried out a two day axle load survey west of Tbilisi on the Tbilisi - Kashuri road in September 1996 as part of the TRACECA Pavement Management System project and intend to make use of the results of this survey for the present study.

Traffic Forecasts

Preliminary forecasts of traffic on the project road have already been prepared on the basis of the projections which were made as part of the TRACECA Pavement Management System project. The Consultants intend to incorporate the traffic forecasts being prepared by W.S.Atkins International in the context of the TRACECA Regional Database and Forecasting Model project, but these will apparently not be available before the second half of March.

The traffic forecasts will cover the full appraisal period of 1997-2025 and they will differentiate between vehicle types. The forecasts will distinguish between normal, diverted and generated traffic where relevant. However, the potential for diverted traffic seems to be very limited given the nature of the roads being studied.

Design of Pavement Repair / Rehabilitation

Based on the field investigations, the laboratory tests results of subgrade and on the forcasted traffic volume the design of repair / rehabilitation of the pavement will be prepared. The design will consider the different requirements of identified sections, traffic volume, existing bearing capacity etc.

The above consideration for pavement and road/highway design have been discussed in detail in the Consultant's study on the REVIEW OF ROAD DESIGN STANDARDS (January 1997) which was prepared under the current TRACECA project and will form the basis for the definitions of technical solutions for improvements and rehabilitation.

Drawings

The study will include drawings with typical details in an appropriate scale for:

- road
- pavement and
- bridges

The data of the road inventory will be presented in straightline design plans showing:

- location
- chainage
- width of carriageway and shoulders
- rise and fall
- roughness and surface condition
- pavement details

A draft straightline design plan is attached in Appendix 3.

Quantity and Cost Estimate

The typical and conceptual (straightline) design drawings together with information on supply of construction material will form the basis for the quantity calculation.
Based on these quantities and Unit rates of recent road projects or if it possible from previous tenders for similar works the cost estimate will be prepared.

Analysis of Road User Costs

Vehicle operating costs for the following representative vehicle categories were analysed for the TRACECA Pavement Management System in September 1996:

Passenger car
Utility vehicle
Bus
2 axle Truck
3 axle Truck
Truck with more than 3 axles

These costs will be updated to take account of any changes in prices and taxes since August 1996. The World Bank's HDM III Vehicle Operating Cost sub model was used to prepare the earlier vehicle operating cost estimates and the same model is being used for this study.

The cost estimates prepared in September 1996 did not include passenger time costs. A decision on whether to include passenger time costs in the basic cost analyses will be made when we have had an opportunity to assess the available information on passenger journey purpose. If it is decided that the available information on passengers' journey purpose is not adequate, passenger time costs will be excluded from the road user cost analysis and their potential significance will be assessed within the context of a subsequent sensitivity analysis. Given the condition of the study road and prevailing income levels in Georgia (and other countries participating in the TRACECA initiatives), it is unlikely that savings in passenger time costs will be a significant component of road user cost savings from road improvement. The same applies to savings in the the costs of goods in transit. The main economic benefits from the improvement of the study roads will, therefore, be from savings in vehicle operating costs.

Economic Analysis of Road Improvement Options

It is intended to use the World Bank's Highway Design and Maintenance Standards Model (HDM III) for the engineering and economic feasibility analysis of alternative road improvement options. The economic analysis will take the form of a benefit-cost analysis which involves the comparison of the economic road user and engineering costs resulting from specified improvement alternatives (the "With Project" case) with the equivalent costs arising in a defined without project scenario ("the Without Situation"). The economic analysis will involve discounted cash flow analysis based on the use of economic costs and the results of the analysis will be expressed as a Net Present Value (NPV), Economic Internal Rate of Return (EIRR), Benefit Cost Ratio (B/C Ratio) and First Year Return (FYR), the latter being used as a guide to optimum timing of investments. The economic costs on which the economic analysis is based will exclude taxes and duties and add back in any identified subsidy elements in prices. An attempt will also be made to identify the foreign components in costs.

For the purpose of the economic analysis the road will be divided into a number of sections with reasonably homogeneous engineering and traffic characteristics. The results of the section level analyses can subsequently be aggregated into larger sections should this be considered to be appropriate and an overall result for each road as a whole can also be produced.

An important part of the economic analysis will be the Sensitivity Analysis. This will test the sensitivity of the the results of the economic analysis to changes in certain of the most important input variables such as base year traffic, traffic growth rates, generated traffic assumptions, engineering costs, and the value of passenger time savings. The purpose of the sensitivity analysis is to establish the robustness of the project togiven plausible variations in underlying assumptions about input values.

Personnel

During the duration of the project the Consultant will provide transfer of technology to the local personnel as on-the-job training.

For the purposes of the feasibility study and with regard to the concurrently running project components the Consultant has reinforced his team by an additional engineer. The Transport Economist / Traffic Engineer will be supported by Mr. Stephen Crudge as Traffic Engineer. The Curriculum Vitae of Mr. Crudge is attached in Appendix 4.

3.4 Tables

The proposed activities for the project are shown in the table below.

OVERALL PLAN OF OPERATIONS

Project title: Traceca Project - Implementation of Pavement Management Systems Feasibility Study for Rehabilitation of Transits Road in Georgia	Project number: TELREG 9305	Country: Georgia	Page: 1
Planning period: 01/1997 - 06/1997	Prepared on: 03/1997	EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany	
Project objectives: **Feasibility Study for Rehabilitation of Transits Road in Georgia**			

No.	Main Activities	TIME FRAME												INPUTS			
		1997 Months												PERSONNEL		EQUIPMENT AND MATERIAL	OTHER
		1		2		3		4		5		6		EC Consultant	Counterpart		
1.	Logistics, data collection		X	XX										3 weeks	3 weeks		
2.	Road and bridge condition survey				XX	XX	XX	XX	XX					8 weeks	28 weeks	FWD, Bump Integrator, Tripmeter, Car,	
3.	Traffic survey and data evaluation				XX	XX	XX							4 weeks	5 weeks		
4.	Geotechnical investigation						XX	XX	XX	X				4.5 weeks	22 weeks	Laboratory Equipment	
5.	Technical solutions						XX	XX	XX	XX	X			8 weeks	16 weeks		
6.	Economic evaluation										X	XX	XX	5 weeks	1 week		
									TOTAL					32.5 weeks	75 weeks		

Form I.4

OVERALL OUTPUT PERFORMANCE PLAN

Project title: Traceca Project - Implementation of Pavement Management Systems, Feasibility Study for Rehabilitation of Transits Road in Georgia	Project number: TELREG 9305	Country: Georgia	Page: 1
Planning period: 02/1997 - 06/1997	Prepared on: 03/1997	EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany	
Project objectives: **Feasibility Study for Rehabilitation of Transits Road in Georgia**			

Outputs	Agreed Objective Verifiable Indicators	Constraints and Assumptions
Road Surface/Pavement Condition	FWD and Roughness Measurements, Visual Inspection	
Bridge Condition	Visual Inspection	
Traffic Engineering	Traffic Analysis and Forecast	
Geotechnical Investigation	Pavement Data, Materials Resources, Laboratory Testing	
Technical Solution	Recommendation, Quantities and Cost Estimate	
Economic Appraisal	Economical Study	

Form 1.5

PLAN OF OPERATIONS FOR THE NEXT PERIOD (Work programme)

Project title: Traceca Project - Implementation of Pavement Management Systems, Feasibility Study for Rehabilitation of Transits Road in Georgia	Project number: TELREG 9305	Country: Georgia	Page: 1
Planning period: 02/1997 - 06/1997	Prepared on: 03/1997	EC Consultant: KOCKS CONSULT GMBH, Koblenz/Germany	
Project objectives: **Feasibility Study for Rehabilitation of Transits Road in Georgia**			

No.	Main Activities	TIME FRAME 1997 Months										INPUTS			
		1		2		3		4		5		6		PERSONNEL		EQUIPMENT AND MATERIAL	OTHER
														EC Consultant	Counterpart		
1.	**Logistics, data collection**																
1.1	Arranging local expertise, office, etc.		X											2 weeks			
1.2	Review existing data bases			XX										1 week	3 weeks		
2.	**Road and bridge condition survey**																
2.1	Visual road inspection				XX	XX	XX	X						2 week	14 weeks	Car, Tripmeter	
2.2	Roughness measurement						X							1 week	1 week	Bump Integrator	
2.3	FWD survey and evaluation							X	XX					3 weeks	3 weeks	FWD	
2.4	Bridge inspection				X	XX	XX							2 weeks	10 weeks		
3.	**Traffic survey and data evaluation**																
3.1	Analysis of existing traffic data				X									1 week	1 week		
3.2	Traffic enumeration				X	XX								1 week	3 weeks		
3.3	Data analysis and traffic forecast						XX							2 weeks	1 week		
4.	**Geotechnical investigation**																
4.1	Pavement investigation						XX							0.5 weeks	4 weeks		
4.2	Subgrade material investigation and sampling						X	XX	X					1 week	10 weeks		
4.3	Laboratory testing							XX	XX					1 week	5 weeks	Laboratory Equipment	
4.4	Geotechnical evaluation								XX	X				2 week	3 weeks		
5.	**Technical solution**																
5.1	Assessment for road improvement, pavement design								X	XX				3 weeks	4 weeks		
5.2	Recommendation for bridge rehabilitation						XX	XX						1 week	4 week		
5.3	Quantity calculation + cost estimate						X	XX	XX	XX	X			4 weeks	8 weeks		
6.	**Economic evaluation**																
6.1	Road user cost savings										X			1 week	1 weeks		
6.2	Economic appraisal											XX	X	3 weeks			
6.3	Sensitivity analysis												X	1 week			
									TOTAL					32.5 weeks	75 weeks		

Form 1.6

APPENDIX 1

FORM 1. - CLASSIFIED TRAFFIC COUNT - HOURLY .

ROAD NO._____

Traffic Section No.:			Direction of Traffic	From:	
Trafic Section Name	From:			To :	
	To:				
Date:			Hour Beginning:		

	Car Jeep	Minibus	Van Pickup Truck <3 tons	Bus	TRUCKS					Motor Cycles	Agricultural Tractors
					2 axles >=3 tonnes	3 axles	4 axles	5 axles	>6 axles		
National											
Inter-national											
TOTAL:											
National											
Inter-national											

APPENDIX 2

TRACECA - IMPLEMENTATION OF BRIDGE MANAGEMENT SYSTEM (BMS)

B R I D G E C O N D I T I O N R A T I N G

GUIDELINES FOR THE EVALUATION OF BRIDGE DEFICIENCIES AND DETERMINATION OF BRIDGE CONDITION CLASSES (MARKS OF CONDITION)

Description of Condition	Mark of Condition	Remedial Works
The structure has no or minor, hardly visible damages only. The deficiencies restrict neither separately, nor in summary the stability and/or the traffic safety and/or the durability of the structure. Examples for typical deficiencies: • dirty facing areas not allowing visual inspection • minor unevenness/rutting of wearing surfaces (carriageway, walkways etc.) • dirty deck joints (expansion joints), bearings and areas around the bearings, joints of steel structures and walkable interiors of structures • not planned vegetation at/on structure • minor alluviated material and/or scouring • dirty/unlegible traffic signs	1	Routine maintenance
The structure has clearly visible damages which do not yet affect the stability. Traffic safety is slightly affected. The existing condition of the structure does not fulfil long term requirements on durability. Examples for typical deficiencies: • minor damages on the bridge furniture and/or it's corrosion protection (railing, guard rails, marker posts, road lights etc.) • bridge furniture in operational condition, but not in accordance with actual standard requirements (out of date) • minor damages on the invert and slope stabilisation, slope stairs, bridge drainage, deck joints (expansion joints), joint sealings • minor damages on the corrosion protection of structural steel units • medium unevenness/rutting of wearing surfaces (carriageway, walkways etc.)	2	Routine and period maintenance and/or repair

Description of Condition	Mark of Condition	Remedial Works
The structure has significant damages, which in short term **may** result separately or in summary in a reduction of stability and/or of traffic safety requiring restriction of use (load restriction, one lane traffic by sign posts/barriers etc.). The existing damages are reducing the durability of the structure. Examples for typical deficiencies: • significant damages on railings and covering plates • significant damages on the wearing surfaces of carriageway and walkways • significant unevenness/rutting in the wearing surfaces • significant damages on the corrosion protection and the coating of structural steel units • erosion and corrosion on the superstructure and the substructure with starting reduction of the cross section area of load bearing components • damages on sealings, joint sealings, drainage of bridge and sealing, erosion/scour protection, hindered bearing movement, which may cause considerable other damages • corrosion with reduction of the cross section area of the reinforcement and load bearing steel components • damages, which are the result of partial failure under load (deformation, cracking, deformed structural elements) • railing, safety furniture, wearing surfaces and other units of the bridge furniture are damaged • cable housings are visible, cable housings without grouting, corroded tendons • longitudinal cracks parallel to tendons	3	Major repairs and/or rehabilitation
The structure has severe damages , which separately and/or in summary reduce the stability and/or restrict the traffic safety. The durability of the structure is considerably reduced. An immediate restriction of use (load restriction, one lane traffic by sign posts/barriers etc.) and/or an immediate removal of the dangers for the restoration of the traffic safety is required. Examples for typical deficiencies: • failure of tendons • significant damages on main load bearing components which are the result of partial failure under load (deformation, cracking in the area of coupling joints, significant cracks parallel to tendons, deformed fastener) • railing, safety furniture, wearing surfaces and other units of the bridge furniture have damages affecting their function considerably • structural units have damages, which cause an acute danger for the traffic (e.g. reduction of the clearance, parts of the structure which may fall on the road)	4	Rehabilitation or reconstruction

APPENDIX 3

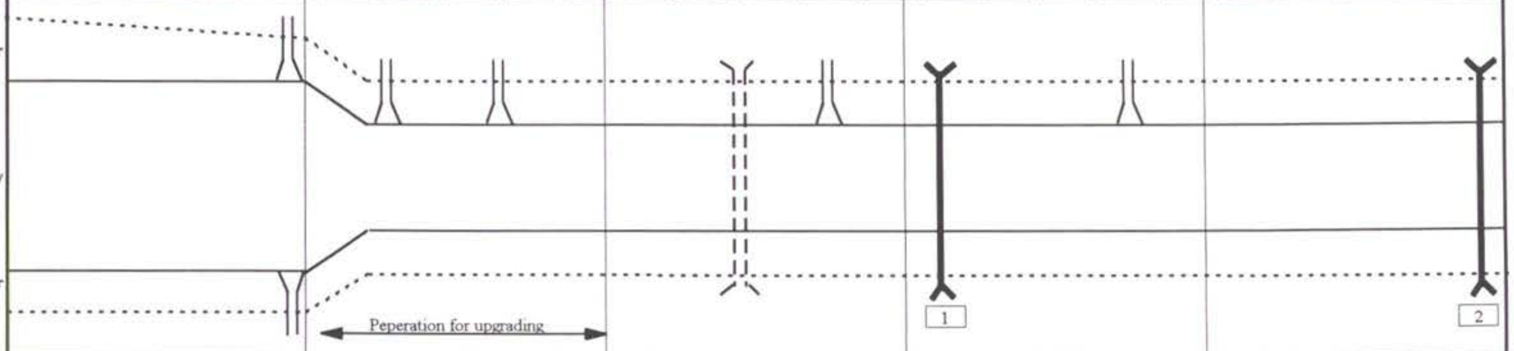
Feasibility Study for Road Rehabilitation

Typical Drawing

Section:

KOCKS INGENIEURE

			km 0	km 1	km 2	km 3	km 4
Location			Junction M 3/M 4; Junction km 0+892	Junction km 1+240; Junction km 1+623	Bridge over Railway; Junction km 2+715	Culvert; Junction km 3+755	Culvert
Chainage		km	0 +000, 0 +200, 0 +400, 0 +600, 0 +800	1 +000, 1 +200, 1 +400, 1 +600, 1 +800	2 +000, 2 +200, 2 +400, 2 +600, 2 +800	3 +000, 3 +200, 3 +400, 3 +600, 3 +800	4 +000, 4 +200, 4 +400, 4 +600, 4 +800
Layout	Shoulder / Carriageway / Shoulder						
Width of Carriageway		m	11,40	14,30; 7,45	8,00	7,70	7,50
Width of Shoulders	L	m	5,35	2,15	3,00	3,00	3,00
	R	m	1,80	2,35	3,00	3,00	3,00
Rise/Fall +/-		%	1,0	1,0	1,0	1,0	1,0
Roughness (IRI)	< 4.0	m/km					
	> 4.0 - 6.0	m/km					
	> 6.0 - 8.5	m/km					
	> 8.5 - 10.5	m/km					
	> 10.5 - 12.0	m/km					
	> 12.0	m/km					
Surface Condition	Cracks	%	1,0	5,0	10,0	5,0	8,0
	Alligator Cracks	%	0,0	1,0	2,0	1,0	3,0
	Potholes	%	0,0	1,0	4,0	1,0	1,0
	Settlement	%	0,0	0,0	0,0	0,0	5,0
	Rutting	%	0,0	0,0	1,0	0,0	3,0
Pavement Structure	New	mm					
	Existing	mm	40 Asphalt; 230 Sand /Gravel				



APPENDIX 4

STEPHEN ANDREW CRUDGE

Position	Senior Transport Economist
Date of Birth	3 January 1959
Qualifications	BA(Hons) Geography, University of Birmingham 1980 MSc Transport Planning & Engineering, Salford University 1982 Member of the Chartered Institute of Transport
Language	English (native), French (basic)

Key Experience

Steve Crudge has gained experience in a wide range of traffic and transportation studies both within and outside the UK. He has worked on major urban transportation models in Kuwait and Hong Kong and national highways studies in Botswana, Lesotho and Vietnam. His particular fields of expertise include traffic surveys and highway network evaluation.

Professional Experience

1996 to date — **TecnEcon, South Kensington**
Senior consultant in the International Projects Division, responsible for traffic surveys, modelling and economic analyses of overseas road projects.

1982 to 1995 — **Scott Wilson Kirkpatrick, Basingstoke**
Transport planner working for both the Transport Planning and Overseas Roads sections. Started as a graduate transport planner working on a variety of UK highway schemes for the Department of Transport covering traffic modelling and economic evaluation. After promotion to senior transport planner he became increasingly involved in projects outside the UK, initially on a couple of planning studies in Kuwait but later on major highway and transportation studies in Botswana, Hong Kong, Lesotho and Vietnam, gaining particular experience in all aspects and types of traffic surveys.

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SIGNIFICANT EXPERIENCE

Appraisal of Binh and Bai Chay Bridges, Vietnam (1996)
Involved in the comprehensive appraisal of the replacement of two ferry crossings by bridges in northern Vietnam for the ODA. With input from a team of specialists he conducted an economic analysis of each of the two proposed bridges to determine both their viability and their suitability for international aid. The assessment covered engineering, operational, traffic, social and environmental aspects with careful attention being given to the modelling of alternatives to bridge construction including improvements to the existing ferry services.

Evaluation of FINNIDA Road Maintenance Assistance to Zambia (1996)
As part of a two man team he conducted a technical evaluation of Phase II of FINNIDA's Road Maintenance Assistance to the Roads Department in Zambia. Phase II is based in Copperbelt Province, running from January 1994 to December 1996. The objective of the evaluation was to assess the effectiveness of all aspects of the technical assistance with particular regard to a possible continuation of Phase III. He took part in meetings and interviews with members of the FINNIDA team and their Zambia counterparts, observed road maintenance operations under the project and was involved in discussions with all interested organisations, including aid agencies in Zambia. The resulting evaluation report detailed the findings of the visit including a broadbrush economic analysis of Phase II and produced recommendations regarding the need for and format of Phase III.

Vietnam Road Strategy Study, Vietnam (1994/95)
Took one of the key, long-term positions on this study of National and Provincial roads in Vietnam, the first ODA funded project in that country. It involved the selection of 6,000km (from 26,000km) of roads for detailed investigation and evaluation with a view to upgrading, plus an assessment of the maintenance costs and priorities for the entire network. Timespan of the complete study was around eighteen months. Steve Crudge's role was that of Senior Traffic Engineer, responsible for all aspects of a wide ranging programme of traffic surveys to provide data for the upgrading and maintenance analyses. The traffic survey programme involved vehicle counts (MCCs, ATCs and Moving Observer Counts), Roadside Interviews (O/D and vehicle operation surveys), speed (uncongested and speed/flow) surveys and Axle Load surveys (using both permanent weighbridges and portable weigh pads). The programme included a significant training input with a national series of seminars followed by on site instruction and supervision. Close liaison was kept with the authorities conducting the surveys and received data was put through a series of checks before and during its entry to the Study database. The end product consisted of detailed traffic information for each link on the priority road network plus a broad assessment of traffic levels on the entire national/provincial network.

After completion of his tour of duty in Vietnam he assisted with the study's training programme by acting as guide on a UK study tour for representatives of middle to senior management from the various highway maintenance agencies in Vietnam.

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Lesotho National Transport Study (1993)
He was responsible for the development of a national road database to be used in the assessment of upgrading and maintenance priorities for the African Development Bank and Ministry of Transport & Communications. This included the organisation of an extensive series of traffic and highway surveys, consultation with each of the three main highway agencies and their regional offices and the assembly and correlation of the resulting data. The surveys included Manual Classified Counts, Roadside Interviews, Axle Load Surveys, Moving Observer Counts and Travel Time Surveys.

He also played a role in various other aspects of the Study which covered the entire transportation sector: assessing the problems and possible solutions for urban roads, particularly in the capital Maseru; the development of a new road numbering system to cover all inter urban and rural roads; quantifying the scale and composition of cross border traffic with the Republic of South Africa, which included a number of trips to interview transport operators in both countries. During part of his stay he acted as local coordinator for the Study which included the hire, allocation and payment of survey staff, liaison with the local client and other Maseru based transport agencies, accounting and office management.

A3 Hook Interchange Improvement Study, London, UK (1992/94)
Responsible for the development and validation of a traffic assignment model to assess alternative improvement schemes to an overloaded, restricted movements junction on the A3 trunk road in south west London. In a second stint, worked on updating the traffic and economic modelling for a revised shortlist of alternative schemes.

A47 East of Thorney to Wisbech, Cambridgeshire, UK (1993)
Directed the use of the Department of Transport COBA programme to assess alternative proposals for a trunk road improvement in eastern England. His role included the provision of advice and training in the principles and application of the program to staff in a regional office.

Hong Kong Freight Transport Study (1992)
Responsible for the development of a freight transport parking model for the territory of Hong Kong as part of a major study covering all aspects of freight transportation. Parking is a serious problem given the severe restrictions on space and high levels of road freight traffic, in particular that associated with the container terminals. Also contributed to the development of the study's trip distribution and assignment models.

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Botswana Road Maintenance Study (1991/92)
This study for the African Development Bank and Roads Department of Botswana covered all aspects of road maintenance in this large and underpopulated country in southern Africa, one particular factor being the preponderance of sand roads in the west which includes part of the Kalahari Desert. He collected and assimilated traffic and highway information for the development of a database covering the national road system, 16,000km in total. This included road number, surface type and condition, highway agency, and traffic levels and composition. Contact was made with the main highway authorities and visits paid to each of the provincial centres. Where information was missing or unreliable, further surveys were carried out, predominantly MCCs but also some vehicle speed surveys. The assembled data were used to develop a road network database with information assigned on a link by link basis. A link numbering system was developed to this end and the database employed to feed information to the HDM-3 modelling of alternative upgrading and maintenance scenarios. He was also involved in the development of proposals for a national road numbering system.

Sheffield Development Corporation Traffic Model (1989/90)
Acted as advisor in the development of a detailed traffic model, using SATURN, covering the former steelworks area in the Lower Don Valley. SDC planned to redevelop the area for light industry, offices, housing and recreation. This entailed many minor changes to the existing road network plus the possible provision of a major link road, from Sheffield city centre to the M1, which was subject to an economic evaluation using COBA.

Transport Model Development, Kuwait (1998)
He assisted in the development of traffic models for the conurbation of Kuwait city in a major study which updated the basic transportation parameters for the country. The SATURN suite of traffic modelling programs was applied at national, metropolitan, CBD and suburban levels in parallel with an assessment of the possible impact of a range of public transport improvements including the provision of LRT and guided busways.

A50 Doveridge Bypass, Derbyshire (1987/88)
Carried out the traffic and economic evaluation of a proposed bypass scheme forming part of the Stoke-Derby improvement. COBA was used to assess a series of alternative alignments on both sides of the village. Additional work concentrated on detailed variations in alignment at the eastern end of the scheme once the corridor for the new road had been selected.

Al Khiran New Town, Kuwait (1986/87)
Responsible for the day to day running of the traffic and transportation aspects of the planning of a new town (projected population 290,000) in southern Kuwait. This involved the development and application of separate but related traffic models at the town-scale and neighbourhood levels. Town scale modelling used Micro-TRIPS while SATURN was employed for the local plans. Considerable attention was paid to the interface between the two suites. Throughout the work a close and flexible relationship was established with those responsible for urban design and planning.