Project name : Technical Assistance to the Southern Republics of the CIS and Georgia – TRACECA : Roads Maintenance
Project No TNREG 9601

Supplementary Progress Report

Pre-Feasibility Studies

Module E

Date of submission
February 1998

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MODULE E

EUROPEAN UNION – TACIS

Technical Assistance to the Southern Republics of the CIS and Georgia
Transport Corridor Europe Caucasus Asia - TRACECA

ROADS MAINTENANCE
PROJECT NO. 9601

MODULE E
PRE-FEASIBILITY STUDIES

SUPPLEMENTARY PROGRESS REPORT
February 1998

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Project Number	:	TNREG 9601
Countries	:	Kyrgyzstan, Uzbekistan and Tadjikistan

Local operator	EC Consultant

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Date of Report	:	November, 1997
Reporting Period	:	24 July – 30 November, 1997
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CONTENTS

1 INTRODUCTION

The purpose of this report is to supplement the information contained in the progress report of December 1997 and to bring the reporting period up to the end of January 1998. It will give further explanation of the objectives of the meetings held and the liaisons undertaken; it will also explain the purpose of the data obtained and the subsequent analysis and assessment undertaken using that data.

It will give details of the engineering appraisal which has been carried out to date, based on the site route corridor visits and the detailed discussions with road and railway engineers from the Design Institutes. It will explain the cost estimating method and give the current draft of the cost estimating database for the three road projects.

The progress which has been made in economic assessment will be outlined; an explanation will be given of why the meetings with, and data collected from, the local experts has been so critical to the work and how it will be used. Finally it will reappraise the resource application and give a revised schedule for the specialist staff input, site visits and priorities.

2 EARLY PROGRESS

2.1 Objectives

The overall objective of the meetings held in the period September to November 1997 was to obtain sufficient information from macro-economic and social data to allow forecasts to be made of likely future road traffic, under a range of economic growth scenarios and population movements.

Further objectives were to enable the engineers to obtain background data, to undertake their engineering appraisal of the projects, to judge the practical problems and construction difficulties and to commence the cost estimating.

Site visits - the purpose of the site visits to the route corridors was to give first hand knowledge of the existing roads and the engineering problems to the Consultant's staff, allowing them the discuss the project in greater detail.

2.2 Achievements and tangible results

The meetings made the Consultant's staff known to a wide range of government officials, specialists and professionals; they helped to promulgate knowledge of the projects within government administrative circles and gave an awareness of the principles of the Studies. The issues of road and rail development in Kyrgyzstan, Uzbekistan and Tadjikistan were discussed in depth at each meeting.

To amplify the brief descriptions given in the November Report - real results were obtained from the meetings - for example:

1. Macro-economics

Mr Kasymkulov, Goscominvest, gave information on current inward investment levels into Kyrgyzstan and the likelihood of future investment and levels;
Mr Pukhtiev, Kyrgyz Ministry of Finance, gave an in-depth analysis of the Kyrgyz economy - its strengths, weaknesses and realistic forecasts for growth. He gave the Consultants a copy of the Economic Indicative Plan for 1998;
Mr Kurmanbek gave the Consultants the government's Capital Investment Programme.
Mrs Abcultanova revealed the up-to-date statistics on external trade and industrial output;
Mr Chynybek, first Vice President of the KyrgyzAltyn (KyrgyzGold), gave details of current mining operations, volumes and expected growth;

2. Power generation

Mr Kasymbekov and Mr Popov, Kyrgyz State Energy Company, gave crucial statistics on power generation and use over the past ten years; they also gave estimates for future demand and details of the current investment programme and planned power station construction;

3. Construction

Mr Gennady gave important details of the major construction projects which are under way and planned for the next period; he also gave statistics on cement production and usage;

4. Social indicators

The many specialists seen by the Consultant's Sociologist provided essential statistics. For example: details of the number and location of hospitals and schools, details of population distribution and agricultural production.

2.3 Specific analysis based on the meetings etc

1 Details of inward investment, trade forecasts and national economic statistics enabled the Consultants to begin forecasting the potential volumes of freight movement; these will be used to perform a superficial check on the WS Atkins Study results and to augment their figures for future traffic flows.

2 Power generation data showed the potential for, and expectation of, industrial growth and consumer demand - both good proxies for national economic activity.

3 Cement usage and the capacity of the existing plants showed the Kyrgyz ability to cope, internally, with major construction projects; in particular the expected production of hundreds of thousands of reinforced concrete railway sleepers. Similar data will be needed on the other essential construction materials.

4 Sociological data has been used to predict both regular movements and possible major migrations of population along the road and rail corridors if the projects are completed.

5 The site visits enabled a first draft of the engineering assessment and cost estimate for the three road projects to be prepared. These costs have been input to the economic analysis model to give an early indication of the level of economic return which would be generated from the road projects using conventional methods.

3 PROGRESS NOVEMBER 1997 TO JANUARY 1998

3.1 Planned results

No visits to the recipient countries were planned for December. The programmed work was to develop the engineering assessment and cost estimating process.

The programmed work:

December:	Engineering assessment of road projects and cost estimating; Engineering assessment of rail projects and cost estimating Liaison with local sub-consultants in Tashkent and Bishkek; Appraisal of social impact of transport projects; Data gathering and macro-economic appraisal of transport projects; Review of existing traffic and freight data; Start building forecasting matrix and Regional network.
January:	Visits to Tashkent and Dushanbe to discuss project engineering and cost estimates with local sub-consultants; Engineering assessment of road projects and cost estimating; Engineering assessment of rail projects and cost estimating; Macro-economic appraisal of transport projects;

Review of existing traffic and freight data;

Continue building of forecasting matrix and regional network.

3.2 Achievements

3.2.1 Meetings and technical liaison

The programmed work was progressed successfully in December and January.

The Highway Engineer, John Foskett, visited Tashkent and Bishkek in January.

Tadjikistan

Road project

John Foskett met Mr Mirzoev, Director of Tajikgirprotransstroy, in Tashkent, he had flown from Dushanbe and driven from Kojent. Over four days they discussed in depth the preliminary engineering assessment and cost estimates for the road project in Tadjikistan and Uzbekistan:

Project No 1- The Summer Road : Dushanbe - Tashkent

A Sub-Consultancy agreement was negotiated and signed for Module E work in Tadjikistan (53 days work).

Mr Mirzoev's staff had been working, compiling background data and information on the road, according to the requests made by the Mr Foskett in September in Dushanbe; a description of this work was included in the Inception Report and the summary proved sufficient to enable them to make good progress. He had no problems understanding what was needed and he handed over a substantial body of data on the existing road, and the wider Tadjik network, its standards and condition.

Mr Foskett made the first payment to Mr Mirzoev for work done by Sub-Consultants, based on a submitted work sheet, for 15 days local expert time used.

Uzbekistan

Road projects

In Tashkent Mr Foskett had a number of very productive meetings with Mr Zukhurov, Head of the Intertechnology Design Centre, and his staff - again discussing in detail the engineering work and costs of Project No 1.

A Sub-Consultancy agreement was also negotiated, over the four days, and signed for Module E work in Uzbekistan (40 days work). Mr Zukhurov's staff will begin work immediately compiling the data on the existing road for Module E.

Rail projects

Mr Foskett met Mr Ismailov, Uzbek Railways Institute, and renegotiated a Sub-Consultancy agreement for 33 days work on Module E rail project work. (The original agreement was only for 8 days).

They discussed the Uzbek rail network and the requirements for background data. Although the rail projects are not in Uzbekistan they do provide vital connections with the Uzbek network. Mr Ismailov and his staff will be asked to comment on, and input to, the emerging rail engineering assessments, cost estimates and economic analyses.

The agreements all require the submission of work sheets showing the activities undertaken, the staff engaged, the number of days spent and the output produced.

Kyrgyzstan

Road and rail projects

In Bishkek Mr Foskett liaised with Mr Alibegashvili and reviewed progress. Mr Alibegashvili had produced considerable background data, according to the agreement signed in November. He had also been using the summary work breakdown contained in the Inception Report and discussed in meetings in November. This data included further details of the railway proposals. It also included sight of the full Feasibility Study Reports, prepared by the Ministry and EC International Ltd of Pakistan, for the road from Bishkek via Issy Kul

and Naryn to the Torugart Pass. A section of this scheme is part of Project No 2, the road from Issy Kul (Balykchy) via Naryn and the Torugart Pass to Kashgar.

Mr Alibegashvili also passed on information on the existing road from Osh to Sary Tash, which is part of Project No 3, the road from Osh to Sary Tash and Kashgar.

Mr Foskett spent four days liaising with Mr Alibegashvili and his staff (assisted, in particular by Mr Rustam Ishenaliev). Their objective was to discuss the methodology and develop the first draft of the engineering assessment and cost estimate for the two road projects in Kyrgyzstan:

Project No 2 - Balykchy (Issy-Kul) to Narin and Kashgar

Project No 3 - Osh to Sari Tash and Kashgar

Agreement was reached on the overall appraisal method and consideration was given to the rates to be used for cost estimating. It was also necessary to look in detail at the engineering works required on the projects - particularly the scale of the assumed work and the desirable road standards to be achieved. It was clear that the Consultants had assumed, in their first drafts higher road standards than had been used in previous improvement and rehabilitation schemes. They considered that the road projects in this current study are to be trans-national links which should, in principle, be designed to **Category II standards, as a minimum.**

The Consultants assumed that the road corridors will need major widening in order to give the full Category II standards, fully adequate drainage

provisions, protection from river erosion, protection from avalanches and stable rock cuttings. The scale of this engineering work was higher than that undertaken on most recent projects and was largely responsible for the relatively high cost estimates. It should be noted that some sections of the on-going Bishkek to Osh reconstruction, adjacent to the hydroelectric dam reservoirs, however, **are** being reconstructed to these higher standards. The Consultants consider that it would be essential for any new, major road project to achieve this wider corridor in order to facilitate winter maintenance and the safe, free flow of traffic.

Realistically, however, the scale of provision must match the likely budgets therefore the standards may be reduced in subsequent analyses, based on the input from the Sub-Consultants.

The Construction Cost Spreadsheets, described further in the next section, have been refined and modified; they are contained in **Annex 1.**

3.2.2 Results produced

The information collected, the meetings held and the appraisal of the routes has enabled a preliminary estimate of construction costs to be completed for the road projects. Input to cost estimates has been made by the Consultant's Highway and Structures Engineers.

The construction cost estimates have been based on an assessment of the terrain, the construction judged to be needed in each type of terrain and the

assumed highway standards. Unit rates have been based on the Bishkek to Osh rehabilitation contract, the Kyrgyz Second Rehabilitation Project (IDB) cost estimates and other cost rates from projects in similar countries with similar terrain.

The costs have been derived from an analysis of the detailed work needed for high standard reconstruction in four different terrain types. Drainage, pavement, structures and earthworks have been quantified for each terrain type and rates have been assigned to give the costs per kilometre for the works in each terrain type.

The results have been put into linked spread sheets in Lotus 123 for each road project. This allows the input parameters to be varied easily and the consequences for the overall cost rates and totals to be seen immediately. The cost spreadsheets have been given to Mr Mirzoev, Mr Zukhurov and Mr Alibegashvili as paper copies and on floppy diskettes.

The Consultants expect the Sub-Consultants to undertake the next stage of their work by commenting on, and adding to, these spread sheets. The feed-back from the Sub-Consultants is seen as an essential part of the Pre-Feasibility Study.

3.3 Deviations from original plan

3.3.1 The planned visit to Dushanbe by the Highway Engineer, to follow-up his site inspection of the Tashkent to Dushanbe road and visit to the Design Institute in September 1997, did not prove possible due to the recent security problems.

3.3.2 The staff input has been varied to reflect the increased emphasis on economic analysis. The figures are, therefore, different from those in previous reports. The Transportation Economist, Mike Evans, and the Economist, Sheila Farrell, have been more active on the project than was planned (TE: 15 days instead of 5 days; Ec: 12 days instead of 3). To compensate, the Project Manager, and the Road and Rail Engineers have been less involved over the period than originally planned. This is shown on the table at Annex 2, which gives the "planned" and "realised" resource inputs.

3.4 Resource utilisation report

The project has been progressed in the most efficient way, according to the Terms of Reference and the Consultant's Proposal.

The Resource Utilisation Chart is in Annex 2, shows the comparison between the programmed resource application for the period and the actual resource used in the period.

Resource usage this period - it was expected that 110 staff days would have been used in the period November - January. Actual time used was 113 days.

Considering the staff time used from the start of the Study :-

- at the end of November 1997, 77 days out of the programmed 264 days had been used, with 187 days remaining;
- at the end of January 1998, 113 days has been used with 151 days remaining.

3.5 Overall output performance report

The Chart showing deviations from the plan and outputs is shown in Annex3.

4 PROJECT PLANNING FOR THE FINAL PERIOD

4.1 Application of Resources

The remaining staff time available to be allocated to the project is:

SPECIALISM	Abbreviation	Name	Time (days)
Module Project Manager	PM	Ken Davies	20
Demographer/Planner	DP	Linda Thorn	3
Transport Economist	TE	Mike Evans	55
Railway Engineer	RE	John Manning	32
Highway Engineer	HE	John Foskett	8
Structures Engineer	StE	Trevor Jenkins	15
Economist	Ec	Sheila Farrell	18
		TOTAL	151

4.2 Proposed visits to recipient countries in the period February - April :-

A revised schedule of staff visits to the countries is at Annex 5.

TIME / VISITS	Specialist staff allocated to the Project							
	PM	DP	TE	RE	HE	Ec	StrE	Total
Total Time in-country (days)	20	14	30	30	39	13	15	161
Days : Feb. - April	15	-	25	16	7	12	15	90
Visits : Feb-April.	2	-	2	2	1	1	1	9

4.3 Proposed work breakdown and programme

Rail Projects

4.3.1 Engineering assessments and cost estimates for the three railway Projects will be produced in February, once the background data has been passed to the Consultants. As discussed with the Sub-Consultants, the rail project descriptions are now:

Project No 4 - Osh to SaryTash, Irkestam and Kashgar

Project No 5 - Osh to Jalabad, Atay then SE to KoshTube, Torugart and Kashgar

Project No 6 - Bishkek to Balykchy (Issy Kul), Kochkor, Atay and Osh; then onward to Kashgar either via route No 4 or No 5

Project No 6 is the so called "Northern Variant", examined in detail by the Russians, recosted by Mr Alibegashvili's engineers and approved by the Kyrgyz government.

The engineering and cost assessments will be similar in style to those completed for the road projects - ie. linked spread sheets, building up the estimates from assumptions about, standards, terrain and the necessary engineering works. In the railway spread sheets these will also include assumptions about wagon turn-around and loadings, train types, power supply, operational characteristic etc. These rail project, spread sheets will also be put onto computer floppy diskette and given to the Sub-Consultants for their comments and input.

Road Projects

4.3.2 Traffic forecasts will be developed for each road corridor. These flows will be derived from consideration of forecasts of long distance freight movements along the corridors and local traffic. Estimates of long distance freight traffic will be taken from the traffic modelling work undertaken by WS Atkins, adjusted where necessary in the light of fresh data and the findings from the macro-economic study. Estimates of local traffic will be based on existing movements along the corridors augmented with findings from the socio-economic study and from consideration of additional traffic that could be generated following the considerable reductions in journey time that will occur. The cost estimates will then be input to the economic analysis and the method and results discussed in detail with the Sub-Consultant's staff and the Counterparts. The detailed methodology is given in Annex 6.

Sociological and Macro-economic assessment

4.3.3 The first drafts of the sociological and macro-economic sections of the final Report will be produced in March. These will endeavour to determine the levels of population movement which will be generated by the new transport facilities. They will also assess the potential for Regional and International increases in trade goods traffic flows; each commodity will be considered to derive the maximum possible flows.

Freight forecasting - Road / rail

4.3.4 Forecasts will be produced of future freight movement for each of the road and rail route corridors. These will be produced from data gathered in the countries and from the macro-economic study. They will consider the likely future increases in trade both between CIS member states and between CIS member states and the key markets of China, and the Middle East. Theses results will be **compared** with that produced in the WS Atkins freight forecasting study which will then be augmented where appropriate. The detailed methodology is given in Annex 6.

4.3.5 The WS Atkins Study will remain the most up-to-date and authoritative study of freight movements in the region.

The forecasting and prediction of future possible traffic freight flows will augment the WS Atkins "scenario" flows. The forecasting and economic analysis will be discussed with the Sub-Consultants when the Transportation Economist and Economist visit the countries in February.

Economic Analysis

a *Road Projects*

4.3.6 The road projects will be assessed using conventional cost-benefit analysis techniques. This involves an assessment of the additional cost of construction and maintenance of the proposed road compared with the existing road. Benefits will be determined from consideration of the savings in journey time and vehicle operating costs of forecast traffic using the new route compared with the existing route. In practise, values of time are very low in developing countries and therefore greater weight will be given to the expected vehicle operating cost savings. Vehicle operating costs will be assessed using the HDM-III Vehicle Operating Cost sub-model. Since cost-benefit analysis principles are based on a comparison of the proposed infrastructure with that which exists it is considered reasonable to use the Winter diversion route in the analysis for Project No 1: the Dushanbe to Tashkent road, even though it is 500 km long and very little traffic moves at present.

The whole analysis will be predicated on the expansion of the local economies and growing GDPs. We must assume that individual affluence and disposable income will increase in order to create markets. Without this assumption the existing situation will prevail, where there are, in effect, few markets in any commodity because few people can afford to buy any goods and the State cannot afford either investment or purchase.

If GDPs are growing and economies are becoming more buoyant, however, then goods will move by whatever routes are available and the costs of transport will be added on to the market values: ie the consumer will ultimately pay the additional travel costs - whether they are for 50 km or 500 km. journeys.

Goods will not move until the market prices are low enough to allow people to buy, but the analysis depends on the assumption that at some stage people's wealth will be such that the prices will be low enough - even with the transport costs added on. At that point the economic analysis can consider the costs and benefits of long diversion routes.

This "thresh-hold affluence" argument is the same for all road schemes in relatively poor countries where little freight moves at present - all analysis depends on the assumption that the overall national economic situation will improve to the point where markets begin to operate rationally.

The Consultants believe that this methodology is the most appropriate to assess the road schemes and is the best method available. Further advice is however being sought .

Vehicular traffic on the three road corridors, other than freight, will be estimated by a combination of applying growth rates to existing classified traffic counts and by estimating total, potential flows based on population distribution. Broad assumptions will be made.

b *Rail Projects*

4.3.7 It is proposed that three growth scenarios are considered and economically assessed - each will relate to different assumptions about national economic growth and increases in trade.

It is recognised that the economic appraisal for the rail projects are much more involved than those for the road. For new rail projects, a comparison must be made with the existing alternative which, by and large, means the existing road. In the development of forecasts it is necessary to disaggregate down to commodity level because the commodity type controls the number of wagons and the number of trains. The economic appraisal will be, essentially, a comparison of the costs of moving goods, by commodity, on the new or improved railway with the costs of similar movements on the existing roads. The capital investment costs would then be balanced against the benefits, which are derived from the vehicle operating costs by road compared with the operational costs by rail, and conclusions drawn for various growth scenarios.

A financial appraisal may also seek to quantify the increased value of the various commodities in their destination export markets , with the transport costs added to them. These transport costs are derived from freight charges applied both in transit and terminal handling charges. This latter would represent, in effect, the net GDP increase due to the project's completion - ie. the "worth" of the project which would need to be compared directly with the capital investment cost.

The benefits of increased employment would also be quantified in a financial appraisal.

4.3.8 The economic analysis for both road and rail projects will be discounted, "internal rate of return" type assessments. The road projects will be based on HDM III parameters, and will include all the relevant and significant cost factors - such as construction costs, vehicle operating costs, time savings(where appropriate) and maintenance cycles. The rail projects will include the costs of construction, operation and maintenance, power usage, service frequencies and the utilisation of wagons (empty running etc). Analysis will be undertaken for various traffic and freight growth scenarios for each of the projects (ie up to 18 analyses)

Transfer of technology

4.3.9 Transfer of technology has been occurring in the discussions with the Sub-Consultants. The Sub-Consultants have been given first drafts of the engineering appraisal and cost estimates for the road schemes. The Consultants will continue to introduce their assessment methods, to the Counterpart and Sub-Consultant staff, as the economic analysis is undertaken in March and April. These methods and the input parameters will be discussed and agreed with the Sub-Consultants.

4.4 Sub-Consultant's work breakdowns

4.4.1 The agreements with the Sub-Consultants included detailed work breakdowns for the projects.

4.4.2 Work programme for the Sub-Consultant's staff, showing maximum number of days work:

Country	Maximum number of days work					
	Railway engineers	Highway engineers	Structures engineers	Economists	Planners	Total
Kyrgyzstan	50	60	15	42	5	172
Uzbekistan	35	5	5	23	5	73
Tadjikistan	0	25	10	13	5	53
Total	85	90	35	78	15	298

Following discussions about workload the Sub-Consultant's agreed maximum total number of days work has been increased from 278 to 298.

4.5 Overall Plan of Operations for Module E (including plan for next period)

The Overall Plan of Operations Chart is included in Annex 5.

4.6 Priority tasks

i) The Sub-Consultants continuing to provide data and comments on the Consultant's draft engineering assessments and cost estimates. The Consultant's staff will continue the liaison with the Sub-Consultants on their planned visits.

ii) Further liaison with Mr Mirzoev of the Tadjik Design Institute in Tashkent on Project No 1. The Consultant's staff will continue the liaison with the Sub-Consultants on their planned visits.

iii) The Consultants refining the methodology for the economic analysis and discussing it with the Sub-Consultants during the planned visits in February and March.

iv) To obtain as much background engineering data on the existing rail network in Uzbekistan as possible.

ANNEXES

ANNEX 1 **Engineering appraisal and first draft of cost estimates for road projects.**

COST ESTIMATE BASE:SUMMARY

US$ per km		
Category	II	III
Pavement width	7.5	7
Shoulder width	3.75	2.5
Side slopes	1:2.0	
Pavement type	Medium	

	Terrain				
Works	**Flat Rolling plains**	**Hilly**	**Mountainous**	**Escarpment**	**Average cost**
Earthworks	119,000	203,000	755,000	2,216,000	823,250
Drainage	14,200	34,800	49,200	67,800	41,500
Structures	89,000	176,250	551,833	3,565,613	1,095,674
Pavement	310,275	310,275	310,275	310,275	310,275
Road markings / signing etc	2,500	3,000	3,500	3,500	3,125
TOTAL COST PER KILOMETRE	**534,975**	**727,325**	**1,669,808**	**6,163,188**	

Note on road classifications:

1. "Rolling plains" includes wide river valleys – characteristics: wide carriageways with good alignments, level grades, metalled surfaces in good or fair condition, sound road sub- bases, adequate drainage and structures
2. " Hilly" refers to Foothills and narrowing valleys - characteristics: variable width carriageways with fair alignments, increasing grades, broken edges intermittent surfacing and potholes but good sub-bases
3. "Mountainous" includes gorges and passes - characteristics: valleys narrowing to gorges with steep slopes up to the road edges, steepening grades with sharp turns and poor alignment, increasing embankment heights, potholes and occasional "washout" erosion, inadequate drainage provision and structures.
4. "Escarpments" are the most severe terrain – characteristics: shear rock or scree faces, steep grades with acute hairpin turns, narrow carriageways with broken edges and unstable road base, loose gravel surface (poorly graded), undefined edges, frequent sub-base failures and serious erosion, drainage provision and structures inadequate.

Earthworks: cost estimate base

US$ per km		
Category	II	III
Pavement width	7.5	7
Total Shoulder width (Cat. II: 3.75, Cat. III: 2.5. each side)	7.5	5
Side slopes	1:2.0	

Earthworks	**Terrain classification**	**Unit**	**Quantity**	**Rate**	**Cost**
Formation Construction	Rolling plains	cu. m.	17,000	7	119000
	Hilly		24,000	8	192,000
	Mountainous		35,000	9	315,000
	Escarpment		45,600	10	456,000
Rock Cutting	Rolling plains	cu. m.	0	0	0
	Hilly		500	22	11,000
	Mountainous		20,000	22	440,000
	Escarpment		80,000	22	1,760,000

Total earthworks cost per kilometre

1. Rolling plains	**119000**
2. Hilly	**203,000**
3. Mountainous	**755,000**
4. Escarpment	**2,216,000**

Drainage: cost estimate base

US$ per km		
Category	II	III
Pavement width	7.5	7
Total Shoulder width (Cat.I: 3.75, Cat. III:2.5 - each side)	7.5	5
Side slopes	1:2.0	

Drainage Works	**Rolling plains**	**Hilly**	**Mountainous**	**Escarpment**
1.Culverts				
Number per kilometre	6	5	6	7
Length (m)	15	15	15	12
Cost per metre	80	160	200	250
Sub-total cost	7200	12000	18000	21000
2. Side drains				
metres per kilometre	800	1200	1000	1200
Cost per metre	6	15	20	25
Sub-total cost	4800	18000	20000	30000
3. Cut-off drains				
metres per kilometre	200	300	400	600
Cost per metre	6	6	8	8
Sub-total cost	1200	1800	3200	4800
4. Additional construction *				
Sub-total cost	1000	3000	8000	12000
Total drainage costs per kilometre	**14,200**	**34,800**	**49,200**	**67,800**

* headwalls/aprons/drop-pits/exit chutes/deflectors/inlet-outlets etc

Structures: cost estimate base

US$ per km		
Category	II	III
Pavement width	7.5	7
Total Shoulder width (Cat II: 3.75, Cat III: 2.5Metres)	7.5	5
Side slopes	1:2.0	

Structures	**Rolling plains**	**Hilly**	**Mountainous**	**Escarpment**
1. Bridges				
Estimated total length (m)	4	5	5	0
Total area (sq m)	60	75	75	0
Cost per square metre	1150	1150	1260	1260
Sub- total cost	69000	86250	94500	0
2. Retaining walls (RC)				
Estimated total length (m)	0	50	200	250
Average height (m)	0	3	4	4
Total area (sq m)	0	150	800	1000
Cost per square metre	100	100	110	110
Sub- total cost	0	15000	88000	110000
3. Gabions				
Average height (m)	0	3	4	4
Estimated total length	0	100	200	200
Cost per metre	450	450	898.6666667	898.6666667
Sub- total cost	0	45000	179733.3333	179733.3333

4. Parapet walls, safety barriers etc

Estimated total length (m)	200	300	500	600
Cost per metre	100	100	150	150
Sub- total cost	20000	30000	75000	90000

5. Avalanche protection galleries

Total length (m)	0	0	10	278
Cost per metre			11460	11460
Sub-total cost	0	0	114600	3185880

Total structures cost per kilometre	**89,000**	**176,250**	**551,833**	**3,565,613**

Notes

Retaining walls and gabions also used for flood protection, as retaining walls and as "deflection" walls to prevent embankment erosion in river valleys.

Avalanche protection galleries assumed to be required for a total of 5 km. over the 18 km length of the Shakhristan pass section (ie 278 m per km over 18 km)

Pavement: cost estimate base

US$ per km		
Category	II	III
Pavement width	7.5	7
Total Shoulder width (Cat.II: 3.75metres, Cat. III: 2.5 metres - each side)	7.5	5
Side slopes	1:2.0	

		Pavement type		
Formation	**Gravel**	**Light**	**Medium**	**Heavy**
1. Sub-Base				
Type	Natural gravel	Graded natural gravel	Graded natural gravel	Graded natural gravel
Thickness (mm)	120	120	200	400
Width (m)	12	15	15	15
Material cost per cu.m.	10	13	13	13
Sub-total cost	14400	23400	39000	78000
Laying cost per sq.m.	5	5	5	5
Sub-total cost	60000	75000	75000	75000
Sub-total cost	74400	98400	114000	153000
2. Road Base				
Type	None	Crushed aggregate	Crushed aggregate	Crushed aggregate
Thickness (mm)		160	160	160
Width (m)		15	15	15
Material cost per cu.m.		21	21	21
Materials cost		50400	50400	50400
Laying cost per sq.m.		6	6	6
Laying cost		90000	90000	90000
Sub-total cost		140400	140400	140400

3. Surfacing

Type	Graded natural gravel	Double seal treatment	Asphaltic concrete	Asphaltic concrete
Thickness (mm)	100	20	50	90
Width (m)	7	7.5	7.5	7.5
Total material (cu.m.)	700	150	375	675
Material cost per cu.m.	10	20	29	29
Materials cost	7000	3000	10875	19575
Laying cost per sq.m.	5	6	6	7
Laying cost	35000	45000	45000	52500
Sub-total cost	42000	48000	55875	72075
Total pavement cost per kilometre	116,400	286,800	**310,275**	365,475

Project No 1: The direct road from TASHKENT to DUSHANBE

Corridor Cost Estimate
(US$)

Location of Section	Chainage	Classification	Cost per km	Length (km)	Cost (US$)
Tashkent	0				
		1	534,975	150	80,246,250
Kojent	150				
		1	534,975	70	37,448,250
Ura-Tjube	220				
		1	534,975	30	16,049,250
Shakhristan	250				
		2	727,325	25	18,183,125
		3	1,669,808	15	25,047,125
Start of Shakhristan high pass	290				
		4	**6,163,188**	**18**	**110,937,390**
End of Shakhristan high pass	308				
		3	1,669,808	32	53,433,867
Ayni (River Saravshan valley)	340				
		1	534,975	5	2,674,875
River Sandarya valley	345				
		2	727,325	20	14,546,500
		3	1,669,808	20	33,396,167
North end of Gissar tunnel approach roads	385				
		3	1,669,808	15	25,047,125
North end of Gissar tunnel	400				
		Tunnel	**24,882,000**	**4.658**	**115,900,356**
South end of Gissar tunnel	405				
		2	727,325	15	10,909,875
South end of Gissar tunnel approach roads	420				
		3	1,669,808	25	41,745,208
		2	727,325	25	18,183,125
	470				
		1	534,975	15	8,024,625
Dushanbe	485				
				TOTAL	**611,773,113**

Project No2: The road from BALYKCHY (Issy Kul) to NARYN and KASHGAR (via TORUGART)

Corridor Cost Estimate (US$)

Location of Section	Chainage	Classification	Cost per km	Length (km)	Cost (US$)
Balykchy (Issy Kul)	179				
		1	534,975	38	20,329,050
		2	727,325	18	13,091,850
Kochkor village	235				
		1	372,313	15	5,584,695
		2	727,325	30	21,819,750
Dolon pass	280				
		3	1,669,808	7	11,688,658
end of pass	287				
		2	727,325	63	45,821,475
Naryn	350				
		2	727,325	4	2,909,300
New Kyzyl-Bel pass	354				
		3	1,669,808	4	6,679,233
end of pass	358				
		2	727,325	38	27,638,350
At-Bashi village	396				
		1	534,975	34	18,189,150
	430				
		2	727,325	42	30,547,650
Ak beit pass	472				
		2	727,325	19	13,819,175
Tyuz-Bel pass	491				
		1	534,975	40	21,399,000
Customs Post	531				
		2	727,325	8	5,818,600
Torugart pass	539				
				Sub-total	245,335,937

Torugart pass	539					
		1	534,975	80		42,798,000
Chi-su-ko	619					
		2	727,325	30		21,819,750
Baykurt	649					
		1	534,975	32		17,119,200
Tishi-Tash	681					
		1	534,975	48		25,678,800
Kashgar, China	729					
					Sub-total	107,415,750
					TOTAL	**352,751,687**

Project No 3: The road from OSH to KASHGAR, China via SARY TASH

Corridor Cost Estimate (US$)

Location of Section	Chainage	Classification	Cost per km	Length (km)	Cost (US$)
Osh	0				
		1	534975	60	32,098,500
	60				
		2	727325	3	2,181,975
	63				
Chyyrchyk Pass		3	1669808.333	9	15,028,275
	72				
		2	727325	11	8,000,575
Bridge (Gulcha)	83				
		2	727325	11	8,000,575
	94				
		2	727325	4	2,909,300
Stone retaining wall	98				
		2	727325	4	2,909,300
Bridge (Kyzyl Korgon)	102				
		2	727325	16	11,637,200
	118				
		2	727325	25	18,183,125
	143				
		2	727325	11	8,000,575
	154				
		2	727325	2	1,454,650
The North "Arch"	156				
		2	727325	7	5,091,275
The South "Half Arch"	163				
		2	727325	13	9,455,225
	176				
Taldyk Pass		3	1669808.333	6	10,018,850
	182				
		1	534975	2	1,069,950
Sary Tash	184				
					0
				Sub - Total	136,039,350

Sary Tash	184				
		1	534975	26	13,909,350
	210				
		2	727325	37	26,911,025
	247				
Irkestam		3	1669808.333	15	25,047,125
Kyrgyzstan / China border	262				
		2	727325	35	25,456,375
Na-ka-la-cha-lo-ti	297				
		1	534975	15	8,024,625
Uluggat	312				
		1	534975	15	8,024,625
	327				
		2	727325	50	36,366,250
	377				
		1	534975	10	5,349,750
	387				
		2	727325	40	29,093,000
	427				
		1	534975	60	32,098,500
Kashgar	487				
				Sub-total	210,280,625
				TOTAL	**346,319,975**

Annex 2 Resource Utilisation Chart

Module Title: Pre-Feasibility Studies	Project No.: TN REG 9601	Countries: Kyrgyzstan, Uzbekistan and Tadjikistan
Planning Period: Sept 1997 - Jan 1998	Prepared on 28 Jan 1997	EC Consultant: Finnroad/Parkman

Module Objective: Pre-feasibility, economic appraisal of six major construction projects (3 road, 3 rail) for strategic links on, or connected to, the TRACECA network

RESOURCES / INPUTS PERSONNEL	TOTAL PLANNED	PERIOD PLANNED	PERIOD REALISED	TOTAL REALISED	AVAILABLE FOR REMAINDER
Ken Davies	30	15	10	10	20
Mike Evans	70	5	15	15	55
John Foskett	47	45	39	39	8
John Manning	47	20	15	15	32
Sheila Farrell	30	3	12	12	18
Trevor Jenkins	20	5	5	5	15
Lynda Thorn	20	17	17	17	3
TOTALS	264	110	113	113	151

NOTE: Planning Period Sept 1997 - Jan 1998
Available For Remainder Feb. 1998 - May 1998

Annex 3 Overall output performance chart

Module Title: PRE-FEASIBILITY STUDIES	Project Number: TN REG 9601	Country: SOUTHERN REPUBLICS OF THE CIS AND GEORGIA	

Planning Period: 9/1997 - 1/1998 Prepared On: 28/1/98 EC Consultant: FINNROAD/PARKMAN

OUTPUTS	Deviations from Plan	Reasons for Deviations	Comments
Existing studies, preferred route corridors for projects. Technical review	None - most data has now been provided		It is expected that the Sub-Consultants will deliver sufficient existing data to enable the economic analysis to be performed
Cost estimates of schemes	None - progressing according to plan		
Demographic/economic/social appraisal and transport sector impact	None - progressing according to plan		
Traffic forecasts/passenger forecasts Freight forecasts	None - progressing according to plan		
Economic analysis of road and rail projects	None - progressing according to plan		

Agreed With: 1) Final recipient 2) Monitoring team

Annex 4 Overall Plan of Operations for Module E (including plan for the next period)

Module Title: PRE-FEASIBILITY STUDIES	Project Number: TN REG 9601	Country: SOUTHERN REPUBLICS OF THE CIS AND GEORGIA	
Planning Period: 8/1997 - 5/1998	Prepared On: 28.1..97	EC Consultant: FINNROAD/PARKMAN	

Module Objective: Pre-feasibility, economic appraisal of six major construction projects (3 road and 3 rail) for strategic links on, or connected, to the TRACECA corridors.

TASK NO.	MAIN ACTIVITIES	TIME FRAME								INPUTS			
		1997			1998					PERSONNEL (DAYS)		EQUIP-MENT	FLIGHTS (1)
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Consultants	Sub-Consultants		
1	**Site visits to route corridors**		XX				XX	X		21		None	4
2	Demographic/economic/social appraisal		XX				XX			22	73		1
3	Transport sector impact			XX		XX				13			1
4	ROAD PROJECTS Traffic forecast			X	XX	XX				24	10		
5	Technical review and cost estimates		XX	XX						34	98		2
6	Economic analysis of projects					XX	XX			34	10		1
7	RAIL PROJECTS Passenger and freight forecasts			XX	XX					24	10		
8	Technical review and cost estimates		X	XXX						32	87		2
9	Economic analysis of projects					XX	XXX			31	10		1
	Final Reports							XX	XX	35			
	TOTALS									**264 days**	**Max of 298 days**		12

Note: Following discussions about workload the Sub-Consultant's agreed maximum total number of days work has been increased from 278 to 298.

Annex 5 Calendar of proposed visits with dates

Name	Date of visit	Working days
John Manning	16 Feb - 24 Feb	7
Ken Davies	23 Feb - 5 March (various locations)	10
Mike Evans	18 Feb - 28 March	9*
Sheila Farrell	18 Feb - 28 March	9*
Trevor Jenkins	18 March - 5 April	15*
John Manning	1 April - 11 April	9
Mike Evans	19 April - 28 April	7*
John Foskett	19 April - 28 April	7
Ken Davies	12 April - 28 April	13

Note:

1 **Normal working week is 5 Days but site visits to corridors may include Saturdays and Sundays as full working Days**

2 **The division of the input between the economists and the engineers is being assessed. These dates may be changed to give more time to the economists and less for the engineers.**

Annex 6 Traffic Forecasting Methodology

TRACECA Road Maintenance Study Module E- Pre-feasibility studies

TRAFFIC FORECASTING & ECONOMICS METHODOLOGY

1. Sub-divide region into zones, based on countries and oblast. An initial examination suggests that about 17 zones would be appropriate, as follows:-

Kyrghyzstan	3 zones based oblasts of Bishkek, Naryn and Osh
Tadjikistan	3 zones based on regions northern, southern and eastern
Uzbekistan	3 zones based on Tashkent and Ferganna Valley, Samarkand and Bukhara, and the western region.
Kazakhstan	2 zones - north and south
Turkmenistan	1 zone
PRC China	1 zone
Indian sub-continent/Iran/Gulf/Africa	1 zone
Caucasus/Turkey	1 zone
Russia/ Ukraine	1 zone
Europe and America	1 zone

2. Elimination of all zone-to-zone movements that are not considered relevant to the corridors being examined.

   Three pre-feasibility study route corridors are as follows:-

Tashkent to Dushanbe	Road only
Bishkek to Kashgar	Road option via Naryn, rail option via Atai
Osh to Kashgar	Road option via Sary Tash/ Irkestam Two rail options, one via Sary Tash the other via Atai.

   Each zone-to-zone pair will be examined to determine whether there is a possibility it would use one of the above corridors. If not, that zone-to-zone movement will be discarded from further consideration.

3. Produce 8 commodity matrices, in annual tonnages, based on the above zoning system using data direct from WS Atkins Study. Using information gathered in the field, trade statistics etc. the 8 commodity matrices will be updated.

4. Prepare cost matrix for all zone-to-zone movements pertinent to each corridor, for each mode. Cost matrix to be formulated from distance matrix and unit costs of movement by road and rail. Road costs to be based on vehicle operating costs, rail costs to be based on rail freight charges which vary by commodity and volume.

5. Allocation of commodities to mode will be based on a comparison of rail and road cost matrix.

6. Three policy scenarios have been defined as follows:-

    1. Existing rail tariffs remain unchanged, existing road vehicle operating costs.

    2. Rail tariffs increased to cover fully rail operational and annual track maintenance costs. Existing road vehicle operating costs to remain unchanged.

    3. Rail tariffs increased as in (2) above, road user charges applied to cover annual road maintenance costs.

    For each of 3 policy options and for each of 3 pre-feasibility study route corridors;

    Identify annual tonnage of each of 8 commodities, for each zone to zone movement that has been identified that will use corridor, that will travel by road or rail. To do this it will be necessary to consider freight charge by road and rail for the whole route of the zone to zone movement. Freight charge for rail will vary by tonnage being considered. Aggregate together zone to zone movements.

    For each commodity, for each corridor, by mode and by policy option to produce total corridor tonnage flows. Convert from annual tonnages per year to number of vehicles or train loads.

7. From WS Atkins data or other existing count data determine existing traffic flows along road corridors. Remove existing proportion of heavy vehicles and replace by freight flow identified in (5) above. Consider increases to traffic flow to account for findings of socio-tourism study and other local generated traffic that may result from road improvement.

8. Produce future year corridor forecasts by mode, by policy option, by pre-feasibility corridor for two growth scenarios, based on:-

    1. Import-substitution, as countries attempt to become self-sufficient in as many commodities as possible in order to reduce imports. This is akin to a low growth scenario.

    2. Free market economy with deregulation, open trading partnerships and foreign investment attracted. This is akin to a high growth scenario.

9. Undertake economic evaluation for each road and rail pre-feasibility route, for each growth scenario, for each policy option.

The road economic evaluation will use traditional cost-benefit analysis comparing discounted capital costs and road maintenance costs with road user benefits derived from savings in journey time and vehicle operating costs. Input will include a full maintenance profile and yearly costs of winter maintenance provision. Output will be IRRs and NPVs. The value of increased employment will be considered as an extra benefit outside the IRR calculation.

The rail economics will also be based on consideration of rail user benefits over using existing road. This will include journey time savings and rail operating costs compared with road operating costs. Input will include full operating costs and track maintenance costs and a proportion of the capital costs, since the full capital cost can be expected to be amortised over a much longer period.