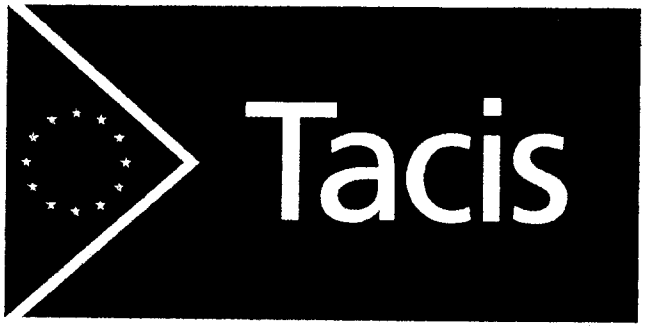

Rail Maintenance Central Asia: Infrastructure Maintenance 2

Draft Final Report

July 1997

Module B

DRAFT FINAL REPORT

Project Title :	TRACECA Rail Maintenance Central Asia: Infrastructure Maintenance 2	
Project Number:	TNREG 9310	
Country:	Kazakhstan, Turkmenistan, Kyrgyzstan, Tadjikistan, Uzbekistan	
	Local operator	EC Consultant
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Date of report : July 1997

Reporting period : July 1996 - July 1997

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Module B

Proposals and Training to Improve Freight and Passenger Traffic on the TRACECA Route

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Executive Summary

Having completed the research in all five TRACECA Central Asia countries, the following points summarise the Consultant's principal findings.

Railway Operations

The current operations are still based on the standards set prior to independence. Few new initiatives are in evidence and day to day matters are handled as before.

In the former Soviet Union railway operations were conceived on a state-wide basis. Communications were based on logistical considerations and only secondary notice was given to the borders between the individual republics making up the union. With the coming of independence however, the newly created states established their sovereignty within their boundaries and as a result new frontiers have to be crossed with the ensuing procedures and restrictions. This has had a marked effect on the Railways in the region in that the operations have been complicated by the fact that services which previously ran on state territory now have to cross frontiers. The situation is further complicated in certain countries in the region by the fact that in order to access different parts of the national territory by rail it is necessary to pass through one or more of the neighbouring countries.

To overcome these problems a few new lines have been planned which are now coming into operation. In many cases however the problem is likely to continue to exist for some time.

A further problem which the new railway organisations are having to face is that of rolling stock: When the FSU was disbanded the rolling stock was distributed, in certain cases somewhat arbitrarily, between the newly created railways. The individual railways are generally dissatisfied with the situation in that they feel „the others" got a better deal.

As wagons are now sent to foreign destinations which were previously national territory, hire charges have to be paid by the countries receiving them. As a result empty wagons are generally returned as quickly as possible to save foreign currency, with the resulting inefficiencies.

A further problem being faced by the railways in the countries of the region is that of repairs and maintenance. The repair shops set up during the Soviet era were planned to service large regions. The newly created railways therefore find themselves either with insufficient capacity or none at all, or conversely with overcapacity in those countries where the repair shops were placed. The necessary agreements and organisation to overcome these problems are still in the early stages.

The train operations themselves are co-ordinated in central dispatching centres or district offices depending on the size of the Railway. Generally passenger trains operate long distance routes connecting national capitals with each other and with Moscow. Some cities have attained popularity and attract many passengers because of the market facilities available, where individuals can exchange goods being transported from China or the Central Asian Republics. The passenger timetables generally provide overnight services so

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that customers can sleep on the train, thereby avoiding overnight lodging costs, and arrive at their destinations in the early morning. Here again the timetables are determined in a centralised fashion from Moscow in the same manner as previous to independence, and the national timetables adjusted accordingly.

In the case of freight trains operations are conducted from marshalling yard to marshalling yard rather than by the use of direct trains on a regularly scheduled timetable. The result is long journey times which put the railways at a disadvantage to other forms of transport, instead of being able to profit from the advantage of being able to haul large quantities of goods over long distances within competitive time limits.

Commercial and Marketing

The concepts of market-oriented commercial competition is still in its infancy in the Railways of the region. The philosophy is still generally that which existed in Soviet times when the railways had an essentially strategic role, with centralised decision-making and no competition from other modes of transport. The consultant was continually confronted with the attitude that the railways had nothing to fear in the way of competition, although a cursory observation of the trucks on the main roads and a visit to a bus terminal indicates the contrary.

The Railways are in many ways restricted in their ability to operate commercially. This is especially the case with regard to passenger transport, where government decisions determine the level of fares rather than market considerations. It is clear that the earnings levels of the population in general are not sufficient to be able to afford higher fares. Nonetheless, the Railways should be compensated for the shortfall, through subsidies based on contracts with the Governments involved.

The fact that tariffs are still determined centrally in Moscow, at annual tariff conferences, also impedes the capacity of marketing and commercial departments in their activities, since this arrangement allows them little room for initiative. However for freight transport it is possible to give contracts to expediters who can then arrange shipments and give discounts. The extent of the activities of these expediters and their freedom of operation varies from Railway to Railway.

Finance and Tariff Policy

The consultant experienced considerable difficulties in obtaining financial information. The reasons for this appear to be twofold: 1) The present systems generally in use are leftovers from Soviet times and serve essentially to record financial transactions rather than to provide meaningful management information, and 2) Such information is regarded as highly confidential, if not secret, and can only be disclosed on authorisation from the highest levels.

The information generated by the financial systems, which are to a very large extent manual, is very general. There is need for the introduction of management accounting methods in order to be able to determine where problem areas exist as well as which services are most profitable. In this respect the Railways need to be reorganised into Business Centres with budgeting along profit centre and cost centre lines, and the Infrastructure separated from

Operations. As part of this reorganisation the systems should be computerised to the greatest extent to which this is feasible.

With regard to the reluctance to provide information on the grounds of confidentiality; this is a problem of philosophy and mentality which must change. The figures which the consultant was able to obtain can not be regarded as reliable for presentation to banks in connection with the obtaining of credits. Before a financial institution can make a decision with regard to the provision of loans it will be necessary to perform detailed audits of the financial statements.

The tariff system is a continuation of that in place during the Soviet era. The 1989 tariffs are updated at annual conferences based on inflation rates and movements in the exchange rates of the currencies of the different countries.

There is need for new systems for tariff determination to be introduced in line with methods used in Western Europe. The new agreements should provide for flexibility to negotiate on an individual contract basis and allow for reaction to market forces in the countries of the region.

Infrastructure Signalling and Telecommunications

Based on the experts' visits, discussions with local executives and technical evaluations of the TRACECA route, the following points summarise the Consultant's principal findings:

- **Signalling**

  The signalling system is generally in good condition and works satisfactorily. However, the poor availability of suitable spare parts to replace older ones is a cause for concern and implies that replacement by a new system using new technology will be required in the short term.

- **Telecommunications**

  In general most of the telecommunication systems are old and suffer from obsolescence. Due to the age of the systems, failures will be more frequent and the situation will become critical within a few years. Most of the former manufacturing capacity in the FSU has been discontinued, so that availability of spare parts is bound to be a problem, e.g. multiplex, PABX, radio, etc.

  It is not considered viable to continue to operate main lines equipped with open wire. For the open wire sections, it is vital to plan the replacement by cables (optical for long distance and copper for permanent way distribution) in the short term.

- **Overhead catenary system (O.C.S.)**

  The line sections which are electrified work correctly and it does not seem that new installations are required in the short term. The present maintenance problem is a lack of money to buy vital replacement parts. In the forthcoming years, if nothing is done, train operation will be heavily disturbed.

In a few words, these networks face serious problems, which are:

- a large part of the equipment has already reached its economic life,
- procurement of spare parts is not possible for older systems,
- if spare parts are still available, money is not,
- obsolete technology is used which needs heavy day-to-day maintenance,
- the logistic requirements for maintenance (cars, trolley, tools, instrumentation) are not sufficient,
- no possibility to enlarge most of the system, not even by system components of western companies,
- increasing number of faults; it is foreseeable that the system will no longer be operable at a specific future point.

Based on the information provided by the different networks, it is clear that two main actions should be undertaken:

The first action is to provide sufficient budget means to the maintenance departments in order to maintain the existing equipment, which has been less than 20 years in operation, and which can be used for at least another 15 years. The last five years, all these departments have suffered a total lack of budgetary funds to buy the necessary materials, tools and spare parts.

The required budget for the maintenance departments is approximately 32.45 million USD.

The budget breakdown is the following:

Kyrgyzstan:
- 0.5 million USD for signalling spare parts and tools.
- 0.25 million USD for telecommunications, instrumentation and tools

Kazakstan:
- 1.0 million USD for signalling spare parts
- 0.75 million USD for telecommunications , instrumentation and tools
- 23.5 million USD for electric equipment maintenance

Uzbekistan:
- 2.0 million USD for signalling spare parts, vehicles and tools
- 0.5 million USD for telecommunications, instrumentation and tools
- 2.35 million USD for electrification department

Turkmenistan:
0.75 million USD for signalling spare parts and tools,
0.5 million USD for telecommunications, instrumentation and tools

Tadjikistan:
0.25 million USD for signalling spare parts and tools,
0.1 million USD for telecommunications, instrumentation and tools

The second action is to invest urgently in the replacement of all equipment over 30 years old which has reached its economic life. If this replacement is applied only in the main corridors, the removed equipment could be used as spare parts for the secondary lines.
There is an **urgent requirement to invest in such measures as replacement of older signalling systems (60's), telecommunication backbone renewal (open wire), and refurbishing of electrified lines** in response to existing difficulties, in anticipation of future problems and in order to meet the traffic demand for the next fifteen years.

The required investment costs to modernise and rehabilitate the main lines have been estimated to a total of approximately:

142.8 million USD.

This total investment is composed of:

Kyrgyzstan:
5.8 million USD for telecommunications equipment

Kazakstan:
38.0 million USD for signalling equipment
36.0 million USD for telecommunications equipment

Uzbekistan:
11.4 million USD for signalling equipment
14.4 million USD for telecommunications equipment

Turkmenistan:
18.0 million USD for signalling equipment
15.0 million USD for telecommunications equipment

Tadjikistan:
2.2 million USD for signalling equipment
2.0 million USD for telecommunications equipment

Abbreviations and Conventions used in this Report

Abbreviations:

AC	Alternative Current
ARE	Austria Rail Engineering
ATS	Austrian Schilling
C&W	Carriage and Wagon
CIS	Commonwealth of Independent States
CTC	Centralised Traffic Control
d.c.	direct current
DEM	Deutsche Mark
DWA	Deutsche Waggonbau AG
EBRD	European Bank for Reconstruction and Development
FDM	Frequency Division Multiplexing
FSU	Former Soviet Union
GHz	Gigahertz (10^9 Hz)
GDP	Gross Domestic Product
Hz	Hertz
ISDN	Integrated Services Digital Network
km	kilometres
KSS	Kyrgyzstan Som
kV	kilovolt (1,000 Volts)
kWh	kilowatt hour
KZT	Kazakstan Tenge
Mbit	megabit, or 1000 bits
Mbit/s	Megabit per second, or 1,024,000 bits/s
MHz	Megahertz (10^6 Hz)
MIS	Management Information System
mm	millimetres
MW	Megawatt (10^6 W)
PABX	Private Automatic Branch Exchange
PSTN	Private Switching Telephone Network
SZhD	Soviet Railways
tkm	tonne kilometres
TRACECA	Transport Corridor Europe Caucasus Asia
USD	United States Dollars
USSR	Union of Soviet Socialist Republics
UZS	Uzbekistan Som
V	Volt(s)
WKR	West Kazakstan Railway

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Conventions:

All costs and prices are expressed in US Dollars (USD) or one of the following local currencies:

Kazakstan Tenge (KZT)
Kyrgyzstan Som (KSS)
Tadjikistan Rouble (TJS)
Turkmenistan Manat (TMM)
Uzbekistan Som (UZS)

and converted, where appropriate, at the exchange rates current at the time.

All units of measurement are in the Metric System unless otherwise shown.

Place names are transliterated from Cyrillic into Latin characters according to English language conventions (other than for locomotive classes and other technical abbreviations where this would prove confusing) or Tacis directives where appropriate. Current (post-independence) names are used throughout, with previous names given in brackets where relevant.

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Introduction

About this Report

This Report summarises the research and recommendations made by the consulting group consisting of the following companies:

DE-Consult Deutsche Eisenbahn-Consulting GmbH, Germany
Austria Rail Engineering (ARE), Austria

in association with Systra, France

and with the following local partners:

Kazgiprozheldortrans, Almaty, Kazakstan
Turkmentransmost, Ashgabat, Turkmenistan
Turkmenzheldorproject, Ashgabat, Turkmenistan
Lebapskoye Road Operation Authority, Chardzhev, Turkmenistan
Turkmendorproject, Chardzhev, Turkmenistan
Techvneshtrans, Tashkent, Uzbekistan
Kyrgyzdortranstechnika, Bishkek, Kyrgyzstan

This consulting group is referred to in the following Report collectively as 'the Consultant'.

The following Report is produced in accordance with the contract issued by the European Union's Tacis Programme for the TRACECA States, Project Number TNREG 9310, 'Rail Maintenance Central Asia, Infrastructure Maintenance 2 Project'. This Project was broken down into three primary modules:

Module A: Feasibility Study for upgrading the Aktau-Bejneu line in Kazakstan

Module B: Proposals and training to improve freight and passenger traffic on the TRACECA route

Module C: Feasibility Study for the Chardzhev Bridge (Turkmenistan)

This Report is concerned entirely with **Module B** as above described.

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Consultant's Personnel and Timescale of the Study

The initial research and field work for the Project was carried out by the Consultant's local partners (see above) in the countries concerned from May 1996 onwards. No local partner was involved in Tadjikistan.

The Consultant's European experts worked in all five countries, together with the local partners, from late August to November 1996 and again during May 1997.

The railways of Kazakstan were, at the time of the research, organised into three companies: Almatinskaya, based in Almaty; Tsellinaya, based in Akmola; and West Kazakstan (WKR), based in Aktyubinsk. Because of the close involvement of the WKR with Module A of this Project, plus the logistical and time constraints, only the first two railway organisations were visited by the Consultant's team.

The European experts engaged in this module of the Project were:

Mr Frank Prescha, Project Manager and Leader of the Infrastructure Team
Mr Norman Griffiths, Team Leader
Mr Bernard Draper, Cost and Tariff Specialist
Mr Jacques Rabouël, Commercial Specialist
Mr Walter Haszmann, Operations Expert
Mr Michael Wogowitsch, Permanent Way Expert
Mr Jean-Michel Bertruc, Signalling and Telecommunication Expert

plus additional staff involved with the organisation and conduct of the European Study Tour

The Consultant was impressed with the professionalism and experience of the discussion partners. This was true for the Consultant's partners at the Institute as well as the Railway Organisations' staff. The only problems were that on occasions it took some time to get accurate records and in certain cases the Railways concerned were reluctant to provide financial information.

1. Existing Conditions for Freight and Passenger Transport

1.1 Assessment of Current Operation Methods, Scheduling

1.1.1 General Assessment

1.1.1.1 Standards and Rules

The current standards and rules for operation methods, train configuration, marshalling procedures, operation control and timetable planning methods, the co-ordination of freight and passenger timetables on each side of borders, the exchange of rolling stock and the signalling and communication systems (radio and phone) and the information systems of the TRACECA route railway organisations (Kazakstan, Kyrgyzstan, Tadjikistan, Uzbekistan, Turkmenistan) are in general still based on the rules valid prior to independence.

1.1.1.2 Network

The national routes resulting from the formation of the new states do not always correspond to the demands of these states. In all five countries, parts of the national territory can only be reached via the line of a neighbouring railway administration. The following example illustrates this problem: A goods wagon from Bishkek (Kyrgyzstan) can reach Jalalabad (Kyrgyzstan) only via Kazakstan and Uzbekistan, thereby spending nearly 80% of the time on the network of a neighbouring administration and having three border crossings. For the use of the foreign railway tracks utilisation charges have to be paid in foreign currency.

To avoid long-haul traffic on the corridors, new railway lines are planned by all except the railways of Kyrgyzstan and Tadjikistan. In Uzbekistan, the first new line parallel with the border to Turkmenistan will go into operation in 1997. In Turkmenistan, a line from Chardzhev to Kerki is already under construction. In Kazakstan, for a better connection of Akmola, the new capital, a line from Jesil to Chelkar and further on to Bejneu is planned.

The railway administrations expect an increase in traffic volume on the newly opened railway route between Turkmenistan (Tedshen) and the Islamic Republic of Iran (Meshed) serving as connection to the Persian Gulf and, via Turkey, towards Western Europe.

The formation of freight trains is done in main and local marshalling yards that are equipped with roll-over humps. Slowing down of the moving wagons is generally by means of scotch blocks (rail slippers).

All railway stations and passing loops have at least two passing tracks.

The condition of the tracks, signalling, safety, telecommunications and data processing installations, however, is inadequate. A renewal of the track and the technical installations is urgently necessary. Spare parts have to be imported, yet it is very difficult to get them and they have to be paid for in foreign currency.

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1.1.1.3 Long-Distance Traffic on the Corridors

Parts of the national territories can only be reached via the national territories of another state.

- Kazakstan: via Russia, Uzbekistan
- Kyrgyzstan: operation and maintenance of the corridor line with Kazakstan was assigned to Kazakstan
- Uzbekistan: via Kazakstan, Turkmenistan, Tadjikistan
- Turkmenistan: via Uzbekistan

1.1.1.4 Rolling Stock

Locomotives, passenger coaches and goods wagons

On the breakup of the USSR, rolling stock of the former SZhD was distributed among the railway administrations. Thus, the rolling stock can be operated without technical or organisational problems on each of the networks of the new states.

The current condition is however inadequate. Because the countries concerned do not have their own rolling stock production, spare parts and vehicles have to be imported. Some workshops are only equipped for minor maintenance works.

Passenger coaches

A large number of passenger coaches are equipped for long-haul traffic. Electric multiple units are only in operation in the Tashkent area of Uzbekistan, and for the operation from Bishkek (Kyrgyzstan) to Balikshi (Lake Issik Kul) coaches with simple equipment are employed.

Goods wagons

Rolling stock with 2 and 4-axle bogies are used.

A wagon hire charge is collected for the time foreign wagons are in the network of a railway administration. This is a daily charge that has to be paid in Swiss Francs. To save foreign money, empty wagons are immediately sent back. Empty foreign wagons are rarely backloaded.

The return of empty wagons or the utilisation of foreign wagons is based on the Regulations governing the reciprocal Use of Wagons in international Traffic (R.I.V.) and is done via the

route the loaded wagon took for its outward journey. With the consent of the railway owning the wagon and the owner of the respective route, a deviation from this rule is possible.

1.1.1.5 EDP Information Systems

The systems used date from before independence. The central computing centre of these systems is located in Moscow, to which remote terminals are linked. The computing centre charges transaction fees for utilisation.

The data stored in the computing centre are used for the preparation of the different statistics and the distribution of revenue.

The following data are stored:

- all vehicles including their technical data, their present location (place or train) and state of loading.
- all sold tickets and seat reservation vouchers including numbers, originating station and destination station, the fee collected,
- all goods transported including commodity, forwarding station and destination station, name of customer, tariff collected

In some departments, locally networked personal computers are used (e.g. staff rostering in Akmola).

Passenger traffic

A sales system including seat reservation is used. All locations equipped for the sale of tickets have access to this system (Express-2).

Freight traffic

A system for loudspeaker direction of wagon marshalling and the preparation of distribution lists for incoming wagons at the marshalling yard is used. This list identifies also the train which will take the wagon onward or the location (track, connecting railway) where the wagon will be positioned for loading (roll-over card).

The clearing of the wagon hire between the railway administrations is executed using this system. Information regarding the present location and state of loading of the wagons can be obtained. This information is given to customers against foreign exchange (e.g. in Tadjikistan).

Planning of staff employment

The personal data of train attendants, their present location (at home or on the train) and their working hours are collected and stored in the local EDP system (e.g. Akmola, Kazakstan) and used for the employment plan.

1.1.2 Operating Methods

1.1.2.1 Co-ordination of Traffic Movement

In principle, all journeys on the line and at the railway stations are supervised by the General Directorate (e.g. Tashkent for the entire Uzbekistan) or, as in Kazakstan, the directorates (in Almaty, Akmola, Aktyubinsk) or in district offices (Atyrau).

The train and shunting routes (turnouts and signals) are controlled by the central dispatcher in the case of remote control sections, in all other sections by the dispatcher (operator) of the railway station.

Operations within 'station limits' (also within marshalling yards) are exempted from this rule. Shunting traffic at these railway stations is co-ordinated between the operator of the station and the dispatcher of the supervisory railway station who also sets up the route and permit for the shunting movements and journeys.

Recording of journeys

The central dispatcher and the dispatchers at the railway stations manually record all journeys in the form of graphic diagrams in a format that also shows the closing of lines. All other received or given instructions, such as the announcement of the arrival of a train, time spacing of trains, written instructions accompanying the trains, are recorded in a separate document.

1.1.2.2 Passenger Trains

Most passenger trains operate over long distances. Long-haul trains normally operate between the capital of the country and the capitals of the oblasts as well as linking the oblast capitals with each other and with stops in larger cities and places with markets. Such long-distance trains are a feature of each of the countries in the region.

In general the departure times of the trains are selected in such a way that the arrival at the destination is in the morning.

Trains with different originating stations, but the same destination stations are often merged into one train during their journey. Trains having sections for different destination stations can be split during their journey.

Local suburban traffic is also operated in all countries other than Turkmenistan. Tashkent (Uzbekistan) has a fairly intensive suburban electric system.

The departure and arrival times of the trains are recorded in the operating control point according to train numbers.

1.1.2.3 Freight Trains

Freight trains can be categorised as follows:

- block trains[1] operating between customers
- wagonload (mixed freight) trains between main or local marshalling yards
- pick-up trains operating between local sidings, stations and marshalling yards for onward movement by wagonload train.

Trains that operate between main or local marshalling yards can take over the collection and/or distribution function on other parts of the line.

In special cases, marshalling yards of the neighbouring railway administration undertake train formation, if the railway station had such a function prior to independence.

1.1.2.4 Operating Parameters

1.1.2.5 Signalling equipment

Turnouts and signals of railway stations and passing loops of main lines are remotely controlled by the central dispatcher.

On other lines, such operations are co-ordinated and authorised by the central dispatcher. These railway stations and passing loops can be equipped with signal boxes with push button geographical circuitry to be operated locally, with mechanical signal boxes or with locally switched key-locked turnouts and signals.

Large railway stations (e.g. Almaty I being also responsible for Almaty II) are equipped with locally operated signal boxes with push button geographical circuitry. The dispatchers co-ordinate the journeys in their sections and they themselves work the turnouts and signals. The exit of trains from the section is co-ordinated with the central dispatcher.

Main lines are always equipped with signal boxes with push-button geographical circuits controlling the automatic block signals and the release of exit signals. This provides information for the automatic train running control system as well as information to the responsible dispatcher's office, to show the movements in the respective section on the geographical control panel.

[1] Block trains are normally defined as freight trains conveying a single commodity on behalf of a single customer, normally operating between origin and destination without intermediate marshalling.

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Automatic train running control

The automatic train running control system transmits the positions of the fixed signals to the drivers' cabins. This operation is only possible on main lines.

Radio communication with trains

Radio communication with trains is available on main lines. In such sections, radio communication is possible between the central dispatcher, local station dispatchers and drivers of locomotives and trolleys[2]; who can also communicate with each other.

Running speeds

In theory, the maximum line speed is 120 km/h.

Because of the condition of many of the tracks and turnouts of the railway lines visited, this speed is only possible on limited sections. The maximum permitted speed of rolling stock is shown in Annex.1.1. *Module A of the Consultant's Report also contains detailed information on this subject in the context of the Aktau-Bejneu line in Kazakstan.*

Inspection of running qualities of rolling stock

This takes place in the originating station and in the designated interchange station for trains or wagons to the neighbouring railway. For the inspection of a wagon axle, 2 minutes are planned. It is common for the inspection of a train having 50 wagons to require 200 to 400 minutes. These inspections are repeated after a distance of 200 to 300 km.

Number of tractive units

In principle, most trains have two tractive units (two single-ended locomotives coupled back-to-back operating in multiple). Block trains are also often driven by three tractive units. On steep inclines, a third locomotive is used as a banker.

Axle load

A general limit of 23 tonnes applies in the whole network of the neighbouring railways, in Russia and the Caucasian Republics, in the Ukraine and in Belarus.

Maximum wagon load

The net payload of freight wagons is up to 60 tonnes (depending on tare weight) for 4-axle freight wagons in the whole network of neighbouring railways, in Russia and the Caucasian

[2] In this context, 'trolleys' (or 'draisine') are small, self-propelled vehicles usually used by the technical support departments, either as personnel carriers, or else for track inspection, infrastructure site work, etc.

Tacis
This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

Republics, in the Ukraine and in Belarus. The gross weight is a function of the number of axles, and is normally 90 tonnes for four-axle wagons.

Brake gear, brake test

The passenger coaches are equipped with a fast-action compressed-air brake. Some coaches are also equipped with an electro-pneumatic compressed-air brake.

The freight wagons are equipped with load-controlled compressed-air brakes. In general, the wagons have a brake force of 34 tonnes.

A brake test is done at the originating station and when the formation of a train is changed.

Coupling

The central buffer coupling is adequate for the transmission of a tractive (pushing) force of 7000 tonnes. Passenger trains in addition have side buffers.

Hot box detection

Main lines (e.g. transit routes) are equipped with infrared detectors for localising hot boxes. A deviation in temperature is indicated to the appropriate dispatcher.

Number of wagons of a train and maximum train length

Passenger trains have a maximum of 23 coaches, freight trains at most 60 wagons. The length of a train generally is not allowed to exceed 850 meters.

1.1.3 Train Configuration and Marshalling Procedures

1.1.3.1 Responsibilities

The dispatcher of the originating station is responsible for train formation in good time, the observation of train formation regulations, the readiness of trains for departure (inspection of running qualities of wagons and coaches, brake test, vehicle dispatch card, brake label, written orders and consignment notes) as well as the procurement of conductors.

The central dispatcher is responsible for the procurement of motive power (locomotives and staff).

1.1.3.2 Passenger Traffic

As previously mentioned, in general, passenger trains generally operate over long distances. Local traffic exists only in some places (e.g. in the Tashkent area, Uzbekistan).

The trains are formed with a locomotive and passenger coaches. Multiple units operate only in Uzbekistan (from Tashkent towards Samarkand for about 100 km).

There is an annual timetable conference of all railways in the CIS countries which regulates all international trains. This includes agreement on the number and types of coaches, the position of the coaches in the train and the arrangement for returning the coaches to their origin point.

For national traffic, the above procedure is undertaken within the country concerned.

Long-Distance trains are made up of the following types of carriage:

- luxury compartment with 2 or 4 sleeping berths
- "Platzkartniy" (semi-open couchette coach)
- a few railways operate open coaches equipped with seating only.

The type and number of coaches, the position of the coaches in the train and the arrangements for returning the coach to home station are contained in a publication which is distributed to the respective train formation stations in the form of a work order.

From Ashgabat to Beikami-Aliy and Turmenbashi (Turkmenistan) special comfort trains which have been bought from a private company operate:

- from Ashgabat to Beikami-Aliy (a sanatorium) there is 1 train per day, to Turkmenbashi (port on the Caspian Sea) 2 trains per day and every other day a third train.

1.1.3.3 Freight traffic, International (Interstate) and National Trains

The route prescribed for a freight wagon to reach its destination station is determined in a system set up before independence. Each railway station has a unique code, which is supplemented by the code of the responsible marshalling yard and/or the code of the frontier point (traffic exchange office for wagons or trains from one railway to the other). The forwarders ("Expediteure") determine the route for international (interstate) traffic.

Freight trains, even those operating internationally, generally only move to the next available marshalling yard.

Timetables for all types of freight trains are produced. In fact, freight trains only operate by directly connecting marshalling yards with each other, and then only when the available traffic reaches the permitted locomotive trailing load or the maximum train length. In other words, trains leave only when full, and **not** on a regular basis according to a timetable.

The movement of each freight train has to be confirmed 24 hours prior to its arrival in the next domestic marshalling yard, or at the designated yard of a neighbouring railway.

There are regulations specifying, for each marshalling yard, the trains to each adjacent yard, their routing, permitted loads and programmed locomotive types.

Wagons on pick-up trains are formed in the originating station in groups corresponding to the order of arrival at destination stations. The wagons added at intermediate stations are not sorted.
In general, block trains are formed at the siding of the forwarding customer and unloaded and split up at the siding of the consignee.

1.1.4 Traffic Control

The central dispatcher offices have a dual function: a **traffic planning function**, co-ordinating traffic requests and having to approve all movements; and a **traffic control function** supervising day-to-day operations. This duality of function is not optimal.

Only rudimentary central supervision of freight traffic could be observed (e.g. in Akmola, Kazakstan or in Dushanbe, Tadjikistan) as an information office for customers.

1.1.5 Timetable Planning

In the organisation chart of each TRACECA railway a timetable department is listed. In Kazakstan there are even timetable departments in the (regional) directorates of the Almaty, Tsellinaya (Akmola) and West Kazakstan (Aktyubinsk) Railway.

The decisions of the timetable conference are incorporated into the national timetable schemes.

The timetables of freight trains are planned and prepared.

The graphical timetables (which include only passenger traffic) for the dispatcher offices, the forms for the dispatcher offices and freight traffic timetables are produced.

1.2 Examination of Current Commercial Organisation

Though a questionnaire had been sent in advance to the different railway organisations that the Consultant visited, no clear answer was given to the question of the commercial organisation of the various companies before arrival. This was mainly because the answering process to the questionnaire was postponed until the Consultant arrived. Some answers arrived only in January 1997, some were never received.

One of the main reasons for the difficulty in answering this type of question may be the cultural differences which make it difficult to interpret the real meaning of the question. This is mainly true in fields which are commercially related (such as finance for example), since the view which the railway managers of these systems have on marketing, commerce and

finance has for very long been very different to what is understood in western railway companies. Therefore, such questions that may seem simple to answer for a member of the commercial department of a EU rail company may cause problems in an organisation that has never faced real marketing questions, fare discussions with customers, or competition from other transportation modes in a liberal market.

In general, among the six railway companies that were visited, a commercial organisation existed, but with goals and responsibilities that would only be a very small part of a commercial department in more advanced systems. Actually, commercial matters were not clearly identified as separate from either the railways' general operations, or from the financial functions of the railway. It must however be remembered that as a rule the Commercial function has even in western railways long been part of the general Operations Department. Freight and Passenger organisations were also found to be strongly linked inside a single organisation. Since the problems of these two categories of customers are obviously very different, as are the techniques in use in both cases, such links do not help to give full independence to the staff in charge, nor to build a strong and efficient commercial organisation.

As far as freight is concerned, the commercial organisation includes several functions:

- Marketing (market research and analysis)
- Conception of commercial rules (including tariffs and their rules of application)
- Sales force (centralised for important customers, and local for others)

Matters are different for passenger traffic, since the link with operations is very much stronger and there is very little flexibility in tariffs, tariff application and practically no marketing at all, as will be shown later.

In reality, most important decisions, such as the level of fares to be applied, are taken outside the commercial department, even though they fundamentally influence commercial activity. The fares to be charged are regularly updated according to inflation and the economy of both the railway company and the country. These decisions are taken by the State, at the company's request, and reflect very little concern with the commercial reality faced by the railways.

In addition it can be said that the commercial organisations remain mainly theoretical. In most cases, and most likely in all cases, they are still in embryo. The conception of tariffs is in fact based purely on the former tariffs applying in the USSR, such as the so-called 10-01 for domestic traffic, the ETT and MTT for intra CIS, and the SMGS when other countries are concerned[3]. These tariffs are mainly based on freight commodity, tonnage and distance, with relatively little discrimination according to these three factors. As far as distance is concerned, the formula is of the form:

[3] In the former Comecon states, the first three applied in the whole organisation, including eastern European states now completely outside this system

$$P = a \times D + C$$

where P is the price, D the distance travelled (the real distance is taken into account, with full standardisation of charges according to standard routes), and a and C constants that depend only on commodity and tonnage. Therefore, the kilometric rate decreases with distance:

$$P_k = P/D = a + C/D$$

but the value of C being relatively small, the decrease of the kilometre rate is also minor.

As far as tonnage is concerned, the same type of function applies, with a slight decrease of the rate per tonne for higher loads. Therefore, and taking the 10-01 tariff, the general formula applying to a particular commodity, of a tonnage T, and sent to a distance D is of the form:

$$P=A_t * T + K_1 + D\,(K_2 + A_d * D)$$

where A_t , $K_{1,,}$ K_2 and A_d are constant dependant on commodity. Such a formula is extremely basic and shows very little adaptation to market conditions and competition pressure from the commercial organisation (##appendix 2.2.2). With different constants, it is also the basis for other tariffs such as ETT and MTT.

The main reason for such a basic commercial organisation, and therefore the consequences relating to its ability to adapt to market realities, is that the former Soviet Union's railway system was completely centralised and that the establishment of tariffs was done entirely in Moscow. It is still very common to hear that "these tariffs have been established by the scientists in Moscow, who know everything about our economy which it is necessary to know in order to establish tariffs", or that "new tariffs are being studied by the scientists in Moscow, and they will tell us when they are ready". Local organisations have very little knowledge of what is really a tariff, how it can be established, and how it can be applied. It will be shown later that the commercial staff themselves think that revenue can be doubled just by doubling the fares and that, moreover, they would not hesitate to do this if they were in a favourable position to do so.

Except for the tonnage passenger fares are based on very similar principles.

There is a deep unawareness of what the market forces really comprise. More worryingly, the concept of market forces is restricted in the understanding of most commercial officers to the client only, and does not include competitors. What the competition offers even now is being completely ignored. For example, long distance coaches are linking main cities together. The railway staff interviewed totally ignored the fact and even seemed shocked when the Consultant stressed the importance of this fact. They had to be advised by the Consultant of the level of coach fares and schedules, which they never even considered to be of interest, moreover such attention to the competitors' qualities was looked upon by them as 'perversity' from bad railwaymen. Almost nowhere did the Consultant find any interest in

the global market. Knowledge not only of the competitors' services, but also their results in terms of market share, revenues, and their costs, is also very poor amongst railway managers.

There is likewise very little thought given to the perspectives of commercial obligations, short term as well as long term. Though traffic has fallen since the break up of the USSR by a factor of 2 to 4 (depending on domestic or international and/or commodity), the general feeling is that an amorphous "Crisis" is responsible, and that traffic will soon come back when the effects of this crisis vanish. Very little attention is paid to other factors, including the underground forces that are changing the economic environment, which may not be affecting all modes of transportation in the same way.

The customers are not, in general, any better treated than previously. No market research is conducted to try to assess their needs, even in simple and inexpensive ways such as simplifying administrative procedures. These are in general very complicated, even for simple travel operations, whether passenger or freight related. The railways do not advertise their products, passenger or freight, and do not even publish any booklet or simple sheet, such as a train schedule, principal fares available, possibility of fare reduction, etc., to help passengers to prepare their journey.

There is a centralised seat reservation system, the central computer being located in Moscow. The system actually also sells tickets since, for long distance trains, reservation is compulsory and is bought together with the ticket itself. This system seems to work well. The Consultant saw no evidence of problems or failure, even though the computer terminals are fairly old.

One final point about the commercial structure of the Central Asian railways (with the exception of Turkmenistan) is, for international freight traffic, the role of the so-called "Expeditor", a kind of forwarding agent omnipresent in the freight transportation process. Since rules and fare application are obscure and subject to the goodwill of various agents, not all of whom are identified and placed along the route followed by the traffic, it is generally simpler for a sender to commit the whole contract to a specialist's care. This specialist is known as the Expeditor. His role is to find a wagon of the right category, determine a tariff with the different railways involved (he is able to negotiate reduced fares from the railways, and the customer may benefit from a part of the reduction), and more generally to deal with all the burdens associated with the traffic (including, thanks to his contacts with colleagues of other countries, to find trains to move the wagon without delay, and to speed it through customs). Of course, such organisations tend to build a barrier between the rail companies and customers, and succeed in placing themselves in such a position that railways cannot avoid them. The railways even transfer to them the right and power to negotiate tariffs with customers, having themselves negotiated a reduced tariff that they pay to the railway, the difference being part of their fee. In some cases, such Expeditors are members of the railway staff, but it was not possible to comprehend whether their role was part of their railway job or in addition to it.

1.3 Tariffs, International Co-operation and Traffic Exchange

1.3.1 Current Tariff Structure

In connection with the proposals to improve freight and passenger traffic on the TRACECA route an examination of the current tariff structure was undertaken. The period of the mission extended from 30th September until 4th November 1996. The contents of this report therefore represent the situation during that period.

The examination involved visits to the Railways concerned with the exception of the Western Kazakstan Railway, which unfortunately could not be included in the itinerary due to the limited time available as well as airline scheduling and other logistical difficulties connected with the amount of travelling which it would have entailed.

In the Railways visited, discussions were held with Railway Management by the experts in the team and whatever documentation which could be obtained was compiled. The information contained in this report is therefore based on explanations and data provided for the consultant and does not represent the results of any detailed investigation or audit.

The responses to previously prepared questionnaires and points raised in the discussions, as well as the readiness to provide information, varied between the individual Railways. It was the Consultant's intention to review the financial results of each railway in order to gain an insight into the extent to which the revenues generated by the tariffs in force were sufficient to cover the costs involved. Unfortunately in most cases written replies to the questionnaires had not been prepared and there was considerable reticence to provide financial information, mainly on the grounds that such data is highly confidential or even secret. Nonetheless, in only one case; that of Almatinskaya Railway, was a request for financial documentation refused outright.

If meaningful assistance is to be given in these areas however, the Railways must provide access to all financial information. Otherwise without this essential basic material no crucial analyses, and therefore significant recommendations for improvements, can be made and the opportunity for a successful completion of the consulting assignment is squandered.

From the documentation obtained it would appear that only very general financial information is assembled and detailed cost reports and other forms of financial analysis either do not exist or are available only to a very limited few. We were assured at each location that this type of information was not prepared.

As the periods spent in the individual Railways were very short, varying from three to five days at each location, no time was available to review the documentation at the locations. A request was made to provide copies of financial statements and similar documentation as part of the pre-submitted questionnaires; see Annex 1.3.1 and again on arrival, but these were in most cases only available shortly before departure and of varying detail. The documentation had then to be translated with the result that only in the home office at the end of the mission was it possible to collate the material gathered.

The information which was obtained is included as Annexes 1.3.2 to 1.3.8. These schedules were prepared to demonstrate the financial results obtained from the tariffs presently in force. It must be stressed however, that the expenditures incurred are not sufficient to provide the necessary maintenance for the rolling stock and permanent way, so that if the normal maintenance were to be performed the expenses would be considerably higher than those recorded. In addition no funds are made available to improve the condition of the passenger services. With the increase of competition from other forms of transport, notably by road, considerable improvements will be necessary if the Railways are to maintain a competitive position.

With regard to the tariffs themselves it was found that the tariffs in force are a leftover from the former Soviet Railways system. Since the collapse of the Soviet Union the tariffs which were current at that time have been updated on a periodic, (yearly), basis, mainly in line with subsequent price developments and inflation rates. This process takes place at meetings attended by the heads of the Railways in the region, at which a percentage increase on the basic tariffs in the various groups is agreed for transport between the countries using the system.
The basic data for the calculation of the tariffs required are contained in a tariff handbook published at the time of the Soviet Union. The tariffs contained therein are incremented by a factor agreed at the meetings mentioned above. For freight transport the tariffs are based on type of goods transported, type of wagon used and distance carried. For passengers the basis is distance travelled and type of accommodation i.e.; sleeping berth, reserved seat, normal seating etc.

Tariffs for domestic transport are established within the countries concerned, usually with the involvement of the appropriate ministries. They are therefore usually lower than the international tariffs depending on the situation in the particular country. Passenger tariffs in particular are well below the operating costs for the services offered. It is recommended that future developments should be oriented towards allowing the Railways more independence, and therefore more responsibility, in the determination of tariffs and economic management.

Forwarding agents are used to varying degrees from one country to another. In Tadjikistan for example the agents are allowed considerable scope for reducing freight tariffs in negotiating with customers. In Turkmenistan on the other hand private agents are not used and customers have therefore little possibility to negotiate reductions.

The consultant requested information showing how the original tariffs were calculated, but in the Railways visited we were informed that such information does not exist. Under the Soviet system tariffs were calculated centrally in Moscow and the regional offices then notified. These tariffs apparently included a profit factor of 35%, which was passed on to the transport ministry to be used for the extension and renewal of the system. From observations made it would seem that although plans are being made to extend the systems, funds are not presently being assigned to enhance the quality of services offered.

At the locations visited no comparisons are made between revenues for individual services and the related costs except for a general separation between freight and passenger services, which is made on the basis of a general reallocation. There are therefore likewise no analyses made to

determine which services within the general groupings of freight and passenger operations are profit making and which are generating losses. In general however it can be said that freight services are cross-subsidising the passenger services, even though the calculation of the extent to which this is taking place may be somewhat arbitrary.

From the information obtained it is therefore apparent that a management information system is a priority need for the Railways in the region, in order for tariffs to be established which are based on the costs involved in maintaining the services provided. In order to furnish these data a computerised system will be necessary.

In the course of the visits made to the Railways, opportunities were taken to view repair shops and other facilities. From these visits and a general impression of the state of the infrastructure and rolling stock observed in all the locations, it can be deduced that the normal maintenance programmes are not being followed and there are considerable problems in obtaining spare parts, mainly for financial reasons. These assessments were subsequently confirmed in discussions with the relevant personnel involved. The **conclusion** to be drawn from this is that the **present tariffs** are therefore **too low** and are **not sufficient to generate funds** to cover completely

- normal operating costs
- regular maintenance programmes
- expenditures for unscheduled repairs
- investments in the renewal of rolling stock and other facilities.

In discussions with railway personnel responsible for freight and passenger services at the locations visited the question of competition with other forms of transport; bus and air for passengers, trucks for goods transport, was always raised in connection with the adequacy of current tariffs and the possibility of increasing them, or alternatively the necessity to request subsidies from the government to compensate for any shortfall. The general feeling appears to be that the Railways have an advantage over the other forms of transport and in most cases there did not appear to be undue concern about loss of revenues to the competition. The consultant's references to past developments in Western Europe and North America appeared to have little effect in changing this attitude.

At all locations bus terminals were visited and enquiries made about passenger fares, from which it can be deduced that the situation in general would appear to be that bus fares are lower and for short to middle distances the time involved is considerably shorter. The Railway personnel countered these arguments with the fact that the Railways can transport much more luggage for the passenger than by either bus or air; an argument which for the near future may have some weight in view of present economic circumstances in the countries involved, where considerable small private commercial activities are conducted between areas with large populations. This situation is however not likely to last indefinitely once the economies of the area become more buoyant. The consultant does not agree with a further argument put forward; that rail travel is also more comfortable.

With regard to freight traffic the advantage of the Railways at present lie in the transport of bulk commodities over long distances. With future improvements in the road networks however this situation is also likely to change.

The **overall conclusion** is therefore that:

- The present tariffs are arbitrarily established and have no basic relationship to the costs of the services concerned.
- The tariffs in force do not generate the required revenue to cover normal operating expenses and provide for improvements in the services offered.
- There is need for a completely new system of establishing and monitoring tariffs both for passengers and freight services.

1.4 International Co-operation and Traffic Exchange

The five countries visited, being newly independent, have had to build new rules for international traffic from scratch, not only with regard to tariffs, which proved relatively simple, at least in the early days of independence, but also for the technically related issues. The problem arising is that, in an integrated mode of transportation such as a railway, technically-related issues impact immediately and strongly on commercial items and solutions to some problems may be correct technically, or politically, but disastrous from a commercial point of view.

As far as the tariffs are concerned, a sound decision was taken at the beginning to apply the former Intra-Comecon tariffs, i.e. the ETT and MTT for international traffic to and from former USSR countries (roughly the CIS plus the Baltic states). However, once the Soviet Rouble ceased to be the single currency, and each country introduced its own new currency (Tenge in Kazakhstan, Sum in Kyrgyzstan, Som in Uzbekistan, Tadjik Rouble in Tadjikistan and Manat in Turkmenistan), this tariff system became more complicated. Most of the currencies were at first affected by very heavy inflation that took away a great part of their value. Therefore, in order to allow customers to pay with their national currency (an absolute requirement, at least for passenger traffic), conferences are regularly held between the members of this agreement to readjust the fares according to the inflation rates of each country. The most recent conference was held in Kiev shortly before the Consultant's arrival in the region. A general problem however, is that these new countries are very young and trust between each other must still be developed. They do not accept easily their neighbours' currencies and prefer to be paid in hard currency, such as US Dollars or Swiss Francs. This means that for money transfers between railways, these hard currencies are used rather than the local money, resulting in financial problems and the interaction of financial organisations.

Unlike domestic tariffs, international tariffs can be controlled by governments only to a limited extent. Domestic tariffs can be artificially kept extremely low by government to avoid

industrial production problems as an example, the same government and the railways however, can take advantage of the situation to enormously increase their international fares, sometimes up to 20 and even 30 times the price of a similar domestic load for the same distance. The price, expressed in US Dollars, of such an international load is about the same as it would be for the same load in Western Europe. The reaction of the customers facing such a high price can easily be imagined, and it is therefore no surprise that international traffic is only one third or one quarter of previous levels in the Central Asian countries. The danger is extremely high that freight traffic, particularly that for the more high-value products, will transfer to a more 'friendly' mode. This is in fact already happening, though the lack of adequate statistics does not allow a clear view on the extent of its present development. However, as an example, the counterparts recognised that the new line from Turkmenistan across the Iranian border, which is hailed overall as the future main route for export to western countries, carries 40 to 50 wagons per day (30 out and 15 in) when at least ten times as many trucks cross the same border by road.

An important problem arising out of independence is that of customs and immigration services and the regulations for crossing borders for passengers and goods. In this case also, in order to manifest its sovereignty each country was required to set up its own customs, police and laws, with little concern for everyday practicalities. Much attention was paid to subjects linked to the local situation and to local problems that may be encountered, such as smuggling, various illegal traffic including weapons, or unwanted immigration or population movements from country to country in the region. As a result complicated rules, applied with more or less good will and efficiency, cause long delays at border crossings, and it cannot be envisaged, according to the people we have met, to run non-stop cross-boarder trains in order to speed-up the traffic. In addition, the boarders are very much indented, particularly in the south-east of the region, and the routes followed by the railways sometimes cross several times from one side of the boarder to the other. A Tadjik train leaving the south of the country first crosses the Uzbek border, then goes through the Uzbek-Turkmen border before it comes back to Uzbekistan, and then further. On the other hand an Uzbek train from the Fergana valley (a place of rich agriculture and industry) cannot join the rest of the country without going through Tadjikistan, on whose territory the outlet of the valley lies.

Conscious of the consequences of such a poor organisation, the five countries entered a process of signing a customs agreement, with the ultimate aim of establishing a customs union. At the time of our visit, and according to a Tadjik government source, progress has been made in this direction, although it was thought that Uzbekistan and Turkmenistan were not entirely technically ready to sign such an agreement. An agreement excluding these two countries, the one being a strongly populated economic partner placed in the centre of the whole region, and the other having a border with Iran, which is an expected source of traffic and a window to western countries through the recently opened line to Mashad and Turkey, would be of little interest.

One of the major problems encountered by the railways with regard to their international co-operation is the exchange of rolling stock. The rolling stock fleet was split between the

various entities created when the USSR collapsed.[4] As is to be expected, no Railway considers itself to be satisfied with the result of the split, finding that each of the others had a better part of the deal. More importantly however, no one now trusts the others, and rules are established based on this conviction.

As an example of the present situation; the countries of the region each have a lucrative service to Moscow, and in the case of Kazakstan to other Russian cities, for which they provide their own rolling stock. The fact of providing the rolling stock entitles the Railway concerned to a significant share of the receipts in line with the revenue sharing agreement. When a country cannot offer the necessary rolling stock however, the Russian Railway as a rule proposes to fill the gap in return for a payment in hard currency. Most railways are unable to sustain this drain on currency over a period of time with the result that trains are often cancelled. For example, no Moscow train ran from Dushanbe for a whole month in September/October 1996, because of technical problems with Tadjik rolling stock. Since major repairs cannot be handled by local shops, which are not equipped with the necessary tools and skills, they must be done in Russian or Ukrainian remote depots. This presents a very difficult situation for the small railways and entails tight financial constraints.

The situation of the Turkmen Railways provides another example. For unclear reasons no cross-boarder trains exist into Uzbekistan and further north into Kazakhstan and Russia. From what the Consultant has observed this is probably linked to the state of the rolling stock. Even the famous Moscow train no longer exists and is replaced by domestic trains to the border point where passengers then connect with an Uzbek train. This situation of course does not help the flow of traffic and, more critically, the image of the railway in the country.

For freight, the old rule applies of sending back an unloaded wagon to the railway to which it belongs via the same route it came. This creates numberless movements of empty wagons between the different companies and it is therefore current to see trains of similar empty wagons moving in opposite directions, each returning proprietary national fleet. Yet, the fleet of wagons is extremely homogeneous throughout these countries, as a result of the splitting up of a homogeneous soviet fleet where very few different types of wagons were currently available in large quantities.. Much energy and money is thus wasted by this lack of trust ("The other Railways will not maintain our wagons properly, they will send us their worse equipment so that we have to repair it at our expense, etc."), as well as lack of organisation and of an agreed regulation as to simply pooling the wagons, or at least those of a standard type.

The main point where international co-operation is still working is for the drafting of schedules. Everything is centralised in Moscow, where the timetables are established by computer; mainly because this is where the central data base exists and the individual countries do not have sufficient knowledge of the constraints faced by the others to allow them to set up separate timetables. It probably is also an excellent way for the Russian Railways to serve their own needs first, since trains run more than half of their total trip on the Russian system. They can therefore in particular adjust the schedule to serve as well as

[4] In general these were the state railways, although in Kazakstan, three major railway companies have been created. There are also some privately owned railways which are of some importance in each country.

possible their domestic needs. Nonetheless, basically, the trip times have not been changed since the independence of the new countries, and no research is made to find out if any change would be appreciated by the customer. The result of such power given to Moscow, allied with a general lack in quality of passenger information, is that often, the schedule shown on station information boards does not match the schedule given by the reservation system, simply because the latter has been updated centrally but the local information has been left in place. The Consultant pointed out this fact to a particular station master, who however, did not seem to be impressed and did not take any measure to correct it.

We will further mention in the performance analysis the very slow average speed of the trains in general, with no exception for international traffic. But let us also mention, to compensate for much criticism, the generally good level of international on-board staff, correctly uniformed, reasonably smiling and friendly, even though they have to apply rules that passengers are no more accustomed to following in modern railways.

1.4.1 Co-ordination of Freight and Passenger Timetables for Cross-Border Traffic

For the planning of cross-border passenger trains, an annual common conference of all CIS countries is held in Moscow.

For freight traffic, there is no comparable conference. However, in the spring of 1996, an informal meeting of the heads of freight traffic of the TRACECA railways was held. The task was to discuss the requirements for the formation of a co-ordinating body. In principle, the necessity of such a body was agreed. The approval of the Directors General (and/or the Governments) is still awaited.

The handing over of freight trains at frontier stations is individually agreed by the central dispatcher offices.

1.4.2 Technical Inspections and Standards of Rolling Stock

In 1991, the railway stations for technical exchange and take over inspections was agreed. For each border, only one railway station was determined. The railway taking over does the inspection, the railway handing over accepting the results. Two minutes are allowed for the taking-over inspection of a wagon. During this time 24 parameters have to be checked.

2. Study Visit to Europe

2.1 Aims of the Study Visit

With the break-up of the Soviet Union, each of the CIS States has taken upon itself the responsibility for its own infrastructure services, including its railway network. Each state must now co-ordinate and manage each service, including the allocation of funds for day-to-day operation, maintenance, refurbishment and capital investment. The break-up of the union has also brought very significant changes in the economy of each state, especially the way in which it conducts commerce and the demands made of the various transport services. All these changes have brought new pressures on the staff of the state railway administrations. Most railways are now expected to operate on a commercial basis. This often means very considerable change in the way the railway company is operated and managed, especially its relationship with government.

Today, the TRACECA States are independent and each has a set of independent infrastructure services, including a railway authority. Each railway authority is fully responsible to its government for the efficient operation of the railway. It must ensure that the railway provides services which the people and the industry of state need. It must also decide how best to use the technical and financial resources available to it and ensure that each user is charged for the services he receives. Hitherto, most of these decisions were made centrally and those now faced with such tasks have had little training and even less practice in strategic railway management. Few possess the necessary skill, confidence and experience. Similarly, the skills needed to analyse data and present the information required by the decision makers were rarely available in the newly independent states.

The demands now being made of the senior managers of the state railways and their support staff are being further increased by other changes. Governments now expect railway administrations to be commercially responsible, so that, while earlier, funds to operate a local part of the railway system were provided with little or no reference to the contribution made to the national economy, now railway management must work within budgets which reflect the revenue earned. Industry is often no longer able to pay the tariffs asked by the railway, but must ask for a competitive transport rate dictated by what the ultimate customer is prepared to pay for the product, delivered to his door. There is also increasing pressure to minimise delays in freight and passenger services. At the same time, railway companies are increasingly subject to competition from trucking firms and sometimes from air and sea transport. Much of the traffic carried by the railways must cross one or more intra-regional or international borders. Most of these borders are new and the various interests which regulate crossing by people and goods inevitably cause delay, including the interface between the now independent railway administrations. For a railway to offer an attractive regional or international service, careful co-operation with contiguous railways and the control organisations is essential. Again, these activities are new to the railway managers in the TRACECA States.

A railway system is a national asset and that asset will be lost if it is not maintained and operated efficiently under present day conditions. This means that the railway management skills available in each of the TRACECA States must be enhanced, especially in the fields of

new investments, commercial operation, response to market forces, international co-operation, relationship with government and the use of up-to-date operation methods and scheduling tools.
According to the Terms of Reference the Consultants organised a study visit for key officers of the various railway administrations in the region so that they can see at first-hand how two railways in western Europe (German DB AG and Austrian ÖBB.) now manage traffic and deal with both competitors and customers and find own solutions for the above mentioned problems in their countries.

2.2 Preparation and Organisation of the Study Visit

2.2.1 Selection of Study Visit Participants

The selection of staff to take part in the study visit was an important element to reach the objectives of the project in terms of the improvement of rail passenger and freight traffic especially with regard to co-operation in international traffic.

For the group, it was proposed that it must comprise a total of eight persons to accord with the Terms of Reference. It was somewhat difficult to understand the logic of the required composition of the group, i.e. eight persons from five different countries (or seven railway administrations including the former three Kazak railways) and the Terms of Reference did not specify further how the study group was to be composed.

An additional problem is the practise on all the railways to make a strong division between passenger and freight staff in the railway administrations. Thus, if the objectives of Module B are to be met, it was impossible to restrict the participation of some railway administrations to only one study visit member.

From the political and professional point of view the consultant proposed with the Inception and the Progress Report to extend the number of participants from eight to eleven people within the total framework of the project budget. This allowed the inclusion of two experts from Kyrgyzstan, Tadjikistan, Turkmenistan and Uzbekistan plus three experts from Kazakstan, having the largest railway network in the area. This approach was supported by the local railway administrations as well by the TACIS co-ordinating units and finally approved by the Task Manager.

In accordance with the defined criteria for the selection of the participants they should:

- have knowledge of the objectives of the project
- be experienced and familiar in at least one of the following subjects: operational methods and commercial organisation,
- be ready to take part in the implementation of reforms,
- have a perspective of professional development,
- be able to contribute to the further spreading of ideas and experience to subordinates,
- and be available.

In order to allow for flexibility in the selection of participants, the Consultant requested the participating railway organisations to nominate a number of participants, from whom it was possible to choose alternative candidates in the event of sickness, passport or visa problems, etc.

In general the nomination of the study visit participants by the recipients proved to be an extremely difficult procedure. The very late nomination as well as different problems concerning the permission to leave the country and the obtaining of the visas caused a delay of the study visit to March 1997. These were the reasons for the absence of the Kazak Tselinaya Railway (replaced by a second trainee from the Almaty Railway).

The consultant wishes to thank the German embassies in the recipient countries as well as the Austrian consulate in Frankfurt-on-Main for being very helpful and unbureaucratic in issuing the necessary visa documents for the participants.

Table
List of railway managers participating in the study visit

1	Mrs Amantchina, S. Ye.	Kazakstan, former Almaty Railway	Tariff and International Traffic Expert in Financial and Economic Department
2	Mr Badambayev, T. T.	Kazakstan, former Almaty Railway	Head of Technical Division in the Operational Department
3	Mr Galper, S. M.	Kyrgyzstan	Head of Wagon Depot
4	Mr Gubatchev, V. A.	Uzbekistan	Deputy Head of International Relations Department
5	Mr Khoudaiberdyev, E.	Tadjikistan	Head of International Traffic Department
6	Mr Mamadjanov, I.	Tadjikistan	Deputy Chief of Container Transport Department
7	Mr Mamedov, M. M.	Turkmenistan	Deputy Head of Operational Department
8	Mr Mirmakhmudov, T. Kh.	Uzbekistan	Deputy Head of Freight Traffic and Commercial Department
9	Mr Sakhatov, A. Tch.	Turkmenistan	Head of Passenger Station Ashgabat
10	Mr Salikov, M. A.	Kazakstan, former Tselinaya Railway	Deputy Head of Freight Traffic and Commercial Department
11	Mr Zubov, N. I.	Kyrgyzstan	Deputy Head of Operational Department

The selected participants represented the fields of work in Module B, covering problems of both passenger and freight traffic from operational and commercial points of view. The

group had a good mix of older experienced railway managers[5] and younger experts and managers predestined for professional development to upper management positions. A big proportion of the trainees was involved in the project performance before and after the study tour. This concerns especially Kyrgyzstan, Uzbekistan and Turkmenistan.

2.2.2 Development of Study Visit Programme

Complying with the Terms of Reference and taking into account also the Consultants' experience in other CIS Republics such as Russia, Ukraine, Kazakstan and Turkmenistan the main objectives of the visit were:

- to advise and explain to TRACECA managers how to shape the railway management in freight and passenger services on a decentralised basis,
- to assist in developing the TRACECA railways according to international standards,
- to assist the TRACECA railways in acquiring modern operational and commercial techniques in accordance with to the rules of the market economy.

The Consultants organised a two week study visit to Germany and Austria whereby an equal portion of the study took place in each country: In Germany at the German Railway (DB AG), organised by DE-Consult, and in Austria at the Austrian Federal Railway (ÖBB.), organised by ARE.

The study courses were presented as lectures, in combination with round-table discussions, questions and answers between lecturers and trainees, case studies as well as visits/excursions to relevant railway facilities. All lectures and experts involved in the study programme were most carefully selected with regard to their professional experience in the field of operation and their acquaintance with up-to-date instruction methods.

The core of the programme consisted of the following key parts:

Part 1: *Information concerning railway restructuring in Europe as in the example of FRG and Austria*

The German Railways (DB) and the Austrian Federal Railways (ÖBB.) have in recent years undergone a detailed and comprehensive process of restructuring. This reorganisation and re-engineering process has now been implemented and should enable the German Railways and the Austrian Federal Railways to function more effectively in the competitive marked-oriented environment. The establishment of cost and profit-centres, business units and new services, follows the provision of the New Railway Law, in accordance with the principles set out in the EC Council Directive 91/440 of June 1991, stipulating the organisational separation of

[5] Especially from the smaller railways which are now having problems because of the lack of skilled staff and therefore can be expected to retain their older managers for a longer term.

- railway operations (passenger, freight traffic)
- railway infrastructure (track, signalling and other fixed installations)

as well as regulating the

- guaranteed access to the railway network for all companies (state-owned and private enterprises),
- payment of fees for the use of the infrastructure by the operator.

During the lectures, the effects of these laws on the legal situation, the necessary changes regarding accounting, the effects on the organisational structure as well as on the necessary re-engineering processes were discussed by means of the new organisational chart of the organisation.

Especially the situation of the staff's work within the change process, as for example the processes of group formation, working within a project organisation, communication and motivation problems on re-dimensioning, were examined more closely.

Another focus was the new cost consciousness through the introduction of internal transfer prices, the improvement of customer orientation, especially with regard to the internal customers, focus on quality and the added value of the service for the orderer.

Part 2: *Operational transport schedules, production systems in freight traffic, train systems*

The participants were informed of the organisational and technical arrangements for deciding operational transport schedules (individual wagon load and block train schedules). They were given information about production systems in freight traffic and train systems such as InterCargo, EuroCargo and InterKombiExpreß.

The development of combined wagon load mode and its present position within the services offered in the field of freight traffic, and a short description of the technical aspects, such as intermodal transport units, type of wagons and terminals, handling facilities as well as problems concerning the clearance between structure and load gauge were presented.

Part 3: *Rolling stock allocation, distribution of empty freight wagons; staff rostering systems and tools used, rolling stock maintenance*

The participants were shown the systems and tools used (manual and computerised) to assist the middle and senior management levels to draw up rolling stock allocation. They got information about a computer system for optimal empty freight wagon distribution.

The systems and tools used (manual and computerised) to assist the middle and senior management levels to draw up staff rostering decisions were explained to the participants including the planning and deployment of locomotive drivers.

The organisational structure with regard to goods wagons, passenger wagons and locomotive operation and maintenance as well as the organisation of maintenance processes were explained (the latter in railway workshops and depots).

Part 4: *Monitoring the execution of train services, including systems and tools used, transport quality and performance indicators, organisation of supervision and control of train operations*

The participants became familiar with the system and tools used to monitor the operation of train services, transport quality and performance indicators. They obtained information about the organisation for supervision and control of train operations, e.g. concerning train monitoring in freight and passenger traffic, information systems regarding train delays, etc.

The new organisation of the Railways required a new orientation towards operations control and the supervision of train traffic, as well as to the creation of new regional offices for operations/route management.

For the example of ÖBB. the nature of the business unit Operations/Route Management, its tasks within the entire enterprise, the success achieved since 1995 as well as a short forecast of the expected aims in 1997 were treated. Moreover, the position of the business unit Operations/Route Management within the organisation and its role as supporting body for the core business of the ÖBB on the one hand and its function as orderer of infrastructural installations for the fulfilment of the tasks ordered by the customers Passenger Traffic, Freight Traffic and Traction on the other hand were presented. An explanation of the business unit Operations/Route Management and its division into operations control, shunting/goods train, operational standards, operational planning, timetable as well as personnel / accounting / controlling / follow-up services was then presented.

The example of the Operations Control East (Austria) was used to demonstrate the internal organisation of an operations control; control office, office for investigation of accidents, control of passenger trains / freight trains, construction management and operations planning and monitoring of operations control. Also the further division of the control office into traffic control, train planning, train announcing, special tasks, dispatching, running schedule supervision was explained.

The increasing competition from other transport modes, the hiving off from national budget funding of the enterprise, including the separation into Commercial Division and Infrastructure, as well as the efforts of the EU to permit

more competition by the admission of third parties to the rail network, make it necessary for the organisation to undergo a consequent cost reduction process and embark on a programme aimed at improving quality.

Whereas for the calculation of the transport performance the project ARTIS from the ÖBB forms a good basis on which modules such as transport information, transport planning and transport statistics can be based, the basis for the calculation of the operational quality has not yet been developed. To be able to quickly achieve results, the project "Quality in Operation" will be started. This project will be executed parallel to a similar project of the German Railways.

Important aims of the project are to reduce the delays by approximately 50 % of EC-trains by 1998 and that of other important trains by 1999. To be able to attain these aims, all important passenger trains have been registered, since January 1, 1997, in a statistics programme which makes it possible to ascribe major delays to the perpetrator. As regards important freight traffic, it is planned to begin a similar statistics starting with the timetable change of summer 1997.

Emphasis was given on special problem of co-ordination of construction management and operations planning on the railways. It is an important subject within the business unit Operations/Route Management of the Business Area Operations Control. The main task are to execute the initial planning and co-ordination of construction activities under traffic operations and to prepare the detailed planning of construction sites by issuing the relevant operating and construction instructions as well as a list of speed restrictions on main tracks and information concerning local characteristic features.

Construction Management and Operations Planning constitutes an important interface between the profit centres of the commercial divisions passenger and freight traffic on the one hand and the technical organisation units on the other hand. Therefore it always forms the interface between the different interests. Thus, one of the tasks of Construction Management and Operations Planning is to enable the execution of the necessary construction work and to keep operational quality as high as possible.

In this regard, the project "Quality in Operation" is very important. In particular, on important and highly frequented main lines the necessary construction work must be executed within the shortest possible time and when a line is closed to traffic it should be utilised by different technical services.

Part 5: *International freight traffic organisation*

The participants were shown how international freight schedules are decided and planned, taking into account commercial, technical and financial requirements: the distribution of information, within and outside the organisation, of these decisions to all interested participants. They were given information about assignment of

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European Freight Schedule Conference (LIM), Convention of Freight Traffic (CIM), etc.

The main tasks and objectives of the Central Clearing House (B.C.C.) in order to reduce the number and amount of payments between its members (the railway companies) by centralisation and balancing of mutual liabilities and receivables, which result from any type of international traffic service and non-traffic services were explained.

Part 6: *International passenger traffic organisation*

The participants were shown how international passenger schedules are decided and planned, taking in account commercial, technical and financial requirements: the distribution within and outside the organisation of these decisions to all interested participants. They obtained information about the assignment of the European Passenger Schedule Conference, Convention of Passenger Traffic (CIV), etc.

A very important point is the reduction of time losses on border stations. The internal EU border crossing regime means a shift from extensive customs and border police control to sample inspections executed by the border police of both countries (mostly on the train). This brings first of all advantages for the passengers and for the attractiveness of the rail passenger traffic in general, but also for operations.

The separation of the functions of the Commercial and Infrastructure divisions at the railway organisations of the EU member countries has also the aim to deregulate the access to the railways' networks (free access without discrimination), to also make possible an access to the network for third parties, and to collect a utilisation charge for the use of the rail infrastructure.

By the commercial divisions fully taking over the costs and profit responsibility, it was clear the "order of the timetable offer" had to be fully shifted into the competence of the business units Passenger Traffic and Freight Traffic. At the same time Operations received the responsibility for the optimum utilisation and provision of the infrastructure.

Because of the resulting changes in organisation at the railway organisations, the international as well as the national procedure of timetable preparation had to be adapted to these developments.

The international co-ordination of route allocation was started in 1997 in a new organisation adapted to the EU requirements - ForumTrainEurope (FTE) - which replaces the present systems CEH (European Passenger Trains Timetable and Through Carriage Conference) and CEM (European Goods Trains Timetable Conference).

Part 7: *Rolling stock use and maintenance in international traffic, overall border crossing procedures*

The participants were shown how the joint use of rolling stock and maintenance facilities between EU railways is organised. They obtained information about the assignment of International Freight Wagon Union (RIV) and of an organisation for common use of freight wagons (EUROP).

On site presentation of border handling activities for goods and passenger trains towards the Eastern European countries and inner EU were presented.

Operational procedures, the border handling of trains at the yard based on the mutual trust inspection system, the proceedings of customs clearance performed in the yard as well as measures within the framework of a technical take-over inspection were presented.

The presentation of the border regime on the inner EU border stations shows how the tasks at a state border can change because of political developments and how the railways can be more attractive by reducing time losses at borders.

Part 8: *Commercial marketing in passenger and freight transport; Competition with other transport modes*

The participants were shown how commercial marketing and sales function within EU railways. They obtained information about the assignment of marketing and the sales organisation in both passenger and freight traffic.

The experience of working in the market with customers and in competition with other transport modes was explained to the participants. They received information about quality, time and price management.

In future, it is absolutely necessary for the railways to offer global logistics solutions. It will not be enough to only transport goods. Stockkeeping, commissioning, packaging and other services are becoming more important.

The increasing flow of commodities within Europe confronts the supplier of transport services with new requirements. The pure transport company belongs to the past. Because of the changing framework conditions within an enlarged Europe, the transportation industry demands new customised system solutions. Rapidity, reliability and an area-covering transport from door to door are the most important factors transport logistics has to fulfil.

During the visit, the most important processes in stock logistics as well as transport logistics were presented and explained.

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Part 9: *Co-operation between EU railways*

The operational, technical and commercial co-operation between EU railways was explained to the participants. They were given information about the role of international organisations in the field of transport for both railway and governmental organisations.

Concerning rail marketing and railway organisation there was no point in explaining in depth all the European orientations for railway operations. In accordance with the objectives of Module B emphasis was put on basic and fundamental notions such as:

- orientation towards real customer needs and wishes
- understanding of competition in passenger and freight traffic
- improvement and simplification of customer information, pricing, payment, etc.
- basis for customers choice of transport modes (role of commercial speed)
- cost reduction by increasing productivity of rolling stock and other railway assets
- cost-oriented assets and stock management (high tech systems and computerisation are not in themselves a source of progress and benefit!).

For the detailed programme of the study visit see Annex 2.1

2.2.3 Organisation of the Study Visit

The study visit took place in the period between March 9 and March 22, 1997.

The first week the trainees were familiarised with the experience of German Railways (March 9 till March 15). Lectures and visits were organised at the Railways Headquarters in Frankfurt-am-Main and Mainz, at DE-Consult's Headquarters in Frankfurt-on-Main as well as at different railway facilities in Frankfurt-am-Main and Munich.

The second week the trainees were acquainted with the experience of Austrian Railways (March 17 till March 21). Lectures were organised mainly in the ÖBB railway training centre in Bad Vöslau near Vienna. A wide number of excursions to different railway facilities in Vienna, the Vienna outskirts as well as in Wels and Salzburg took place.

The team of lecturers included high-staff managers and experts from the Joint Stock Company German Railway (DB AG) and from the Austrian Federal Railways (ÖBB), as well as managers and experts of the consultants' companies

From their arrival until their departure, the participants were cared for by the study tour managers and the translator who brought them to the respective locations, and provided for their physical comfort.

For the detailed programme of the study visit see Annex 2.1

2.3 Evaluation of the Study Visit

At the end of the study visit in both Germany and Austria the Consultants held discussions with all the participants in order to evaluate the effectiveness of the study visit as compared to the initial objectives.

To this end a specific questionnaire was used containing 10 questions and 4 sub-questions. The highest note was 5, the lowest -1. The result of the evaluation can be summarised as follows:

N°	Question	Avg. Value	Range of notes
1	Understanding of study tour goals	5.0	5 only
2	Meeting of individual requirements	4.9	4-5
3	Methods of presentation in accordance with objects of the visit	4.9	4-5
4	Relevance and helpfulness for own future work	4.8	4-5
5	Topics of the visit programme covered own expectations and were interesting	4.5	3-5
6	Competence and helpfulness of the consultant's escort during the visit	5.0	5 only
7	Willingness of lecturers to answer questions & advise on problems of Central Asian railways	4.8	4-5
8	Professionalism and competence of lecturers	4.9	4-5
9	Necessity to change programme in future	3.5	3-5
10a	Overall quality of the organisation (a) in participants' homelands	3.7	1-5
10b	Overall quality of the organisation (b) in Europe	4.9	4-5

It has to be noted that the big differences in the answers to question 10a are caused by the different level in quality of the logistical preparation of the study visit by the railway and governmental administrations of the participants concerned. The most negative votes were from the Kazak and one of the Tadjik participants arriving late in Europe because of the poor level of local preparation (permission to leave the country, receipt of foreign passports, etc.). The consultant successfully undertook all in his power to permit these participants to come to Europe.

To question 9 the participants had the opportunity to answer verbal on two questions: i) what was of special interest for you, and ii) which themes should be included in future study programmes. Taking into consideration the different professional backgrounds of the participants a very wide range of answers were received:

No.	Question 9.1 Which subjects were the most interesting for you?	Question 9.2 Which subjects were missing and should be included in future programmes?
1	Information concerning co-operation of the railways within the framework of the EC and the role and importance of different international railway organisations.	Planning and re-expedition of goods within the CIS and in international transport. Also, the procedures of work with freight documents.
2	Marketing, service for passengers, operation of wagon stock.	More details for passenger traffic experts.
3	Problems of freight wagon stock operations on the joint stock company German Railways; Information concerning planning and organisation of traction stock operation and maintenance. Operation of traction stock in international traffic. Information concerning the co-operation of the railways within the framework of the EC and the role and importance of different international railway organisations.	Problems of safety in train operation. Organisation of train control.
4	Co-operation of the railways within the framework of the EC.	Tariff policy in Germany and other European countries. Tariff structure, various kinds of tariffs and prices for railway services.
5	Information concerning co-operation of the railways within the framework of the EC.	
6	Organisation of freight traffic and freight tariffs.	Remarks: Very satisfied with the study tour, receiving information about the organisation of railway performance in Germany, organisation of passenger services as well as services for shippers and consignees. The only remark for the organisation of TRACECA is to receive more additional written material, tables, etc. in Russian.
7		Remarks: It seems more useful to select the groups of trainees separately for the different groups of experts (e.g. operation experts, freight traffic specialists, wagon stock specialists, locomotive specialists, etc.)

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8	Presentation of the Joint stock company German Railways, its present state, short introduction to the goals and objectives of the railway restructuring.	More details about container traffic.
9	Information about the problems of freight wagon distribution and exchange of rolling stock with the neighbouring railways.	
10	Co-operation of the railways within the framework of the EC. Introduction of the production system DB Cargo for the freight traffic of the German Railways.	

In general the participants were very interested in the visit's objectives, problem-conscious and very often asked the lecturers concrete questions. All participants saw future challenges regarding railway restructuring of the same kind for their own railways and wanted to know more about practical procedures of restructuring, problems of deployment as well as effects on the staff members.

The feedback showed that there is still a big demand by the participants for more detailed information and support with regard to the railway restructuring especially with regard to tasks within their own organisations.

The participants were also strongly interested in new technologies and the technical installations used in Europe and their operation.

The participants were satisfied with the proposed mix of lectures, discussions and on-site visits.

The positive acceptance of the lectures was also found in short comments of the lecturers to the consultant.

A major problem born by the wide range of tasks to be covered in accordance with the Terms of Reference of the given project was the very different professional background of the participants. For future projects it would be wise to concentrate study tour contents and participants on a smaller professional field to have the opportunity to go even more into details.

3. Recommendations for Improvement

3.1 Operation

3.1.1 General recommendations for improvement

In the following, recommendations for improvement having direct or indirect consequences on operation are presented.

Standards and rules

Standards and rules being necessary for a smooth exchange of rolling stock, handing over of consignment or information (data) regarding the rolling stock and consignments to be exchanged between the railway administrations shall only be changed or newly created upon agreement by the respective railway administrations.

A modification of the standards and rules being valid for this field without common agreement aggravates the existing transport situation at the expense of the customers, and thus will have a negative influence on the economic situation of the railway administrations.

An international body such as the „Organisation for the collaboration of railways, OSShD, Warsaw", can guarantee that the coherence of the railway system will be kept by promoting interoperability.

Network

An improvement of the reliability of train circulation and the utilisation of the rolling stock used, can only be reached after a comprehensive **renewal and upgrading of the existing routes** and the resulting shorter travelling times of the trains.

The following tables summarise the international railway routes defined by the TRACECA programme, the Pan European Transport Conference (CEMT), the Economic Co-operation Organisation (ECO) with their declaration of Ashgabat and from the national point of view, which require comprehensive renewal and upgrading.

Kazakstan

Programme	Routes	length in km
TRACECA	Aktau - Arys - Almaty - Druzhba (China)	4,067
	Arys - Shengeldy - Sary - Ogach (Uzbekistan)	78
	Lugovaja - Chaldova (RSD 70) (Kyrgyzstan)	60
CEMT	(Russia) Uralsk - Arys - Aktogay - Druzhba (China)	3,591
	(Russia) Akmola - Mointy - Aktogy - Druzhba (China)	1,406
ECO	(Uzbekistan) Sary - Ogach - Arys - Druzhba (China)	1,696

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National	(Russia) Presnogorkovskaja - Mointy - Druzhba (China)	2,038
	(Russia) Tobol - Akmola	598
	(Russia) Uralsk - Arys - Almaty - Druzhba (China)	1,972
	(Russia) Seksariskaja - Makat - Aktau	1,176
	(Uzbekistan) Sary - Ogach - Arys - Aktogay - Druzhba (China)	1,458
	Makat - Kandagash	392

Kyrgyzstan

Programme	Routes	length in km
TRACECA and national	(Kazakstan) Chaldovar RSD km 70 - Bishkek - Balykchi	262

Tadjikistan

Programme	Routes	length in km
TRACECA	(Uzbekistan) Sariassja - Dushanbe	80
National	(Uzbekistan) Amusant - Kurgan Tuba - Kulab	231
	(Uzbekistan) Bekabad - Hudzand	99
	Dushanbe - Kurgan Tuba, 760 mm gauge*), not in the property of Tadjikistan Railway. During winter time this line is operated by the Ministry of Interior for the supply of the Region Kurgan Tuba	

*) It is recommended to install a continuous operation of the line by Tadjikistan Railway in order to avoid detours through Uzbekistan and Turkmenistan after a modernisation of the tracks and rolling stock.

Turkmenistan

Programme	Routes	length in km
TRACECA	Turkmenbashy - Chardzhev - Farab (Uzbekistan)	1,141
	Tallymardzan - RSD 162 (Uzbekistan)	333
ECO	Seraks - Tedzen - Chardzhev - Farab (Uzbekistan)	585

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Uzbekistan

Programme	Routes	length in km
TRACECA	(Kazakstan) Tashkent - Samarkand - Farab (Turkmenistan)	710
	Samarkand - Tallymardan (Turkmenistan)	204
	(Turkmenistan) RSD - Termez - Amusant (Tadjikistan)	202
	Termez - Sariassaja (Tadjikistan)	172
ECO	(Kazakstan) Tashkent - Samarkand - Bukhara - Farab (Turkmenistan)	710

The following table summarises the total length of routes for each country defined by TRACECA, the Pan European Transport Conference (CEMT) and the Economic Co-operation Organisation (ECO) in the Declaration of Ashgabat and by the national programmes, which require renewal.

Country	TRACECA in km	CEMT in km	ECO in km	national in km
Kazakstan	4,205	4,997	1,691	7,634
Kyrgyzstan	262			262
Tadjikistan	410			410
Turkmenistan	1,474		585	585
Uzbekistan	1,288		710	710
Total length	7,639	4,997	2,991	9,601

This table presents the length of routes which have been proposed by more than one of the programmes for renewal.

	length in km
TRACECA, CEMT, ECO, National (Kazakstan) Arys - Almaty - Aktogay - Druzhba (China)	1,619
TRACECA and ECO (Kazakstan) - Arys - (Uzbekistan) - Tashkent - Bukhara (Turkmenistan) - Farab - Tedzen	1,180
TRACECA, CEMT and national (Kazakstan) - Kandagash - Arys	1,333
TRACECA and national (Kazakstan) Aktau - Makat - Kandagsh	1,030

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(Kazakstan) Lugovaja - (Kyrgyzstan) - Bishkek - Balychi	322
(Uzbekistan) Sariassaja - (Tadjikistan) - Dushanbe	80
(Uzbekistan) Amusant - (Tadjikistan) - Kurgan Tuba - Kulab	231
(Uzbekistan) Bekabad - (Tadjikistan) - Kanibadam	99
CEMT and national	
(Russia) Uralsk - Aktubinsk - Kandagash	639
(Russia) Tobol - Akmola - Mointy - Aktogay	1,692

Further details concerning infrastructure development plans are presented in Chapter 4. Railway Infrastructure in Central Asian TRACECA Countries.

The renewal and upgrading of the existing lines can be done mechanically or together with a manual track maintenance. Based on the technical equipment for track maintenance available in the countries concerned 2 months will be required to renew about 10 km track length. With modern equipment and qualified staff together with operational measures the time for the renewal of 10 km track length can be reduced to 3 - 4 weeks.
There are no industrial enterprises producing the necessary machines and material. Imports of material and spare parts as well as the repair of machines abroad have to be paid for in foreign currency. Some spare parts are no longer available.

An improvement of the existing situation can be achieved by:

a) **a renewal and upgrading of the lines.** With the present availability of qualified staff, a combination of mechanic and manual renewal is more cost-advantageous and can be recommended out of an economic point of view.
b) **a reduction in dependence on imported material and machines.** This can be achieved by a promotion of the existing national industries or by the foundation of suitable enterprises which will not only work for the railway administration. The know-how regarding the utilisation of modern material and production methods which is lacking at the national enterprises can be granted by admitting joint ventures.

The renewal and upgrading of the lines as well as modernisation and new construction of railway lines should not only be executed according to national aspects, but, where applicable, also according to international (interstate) traffic.

The countries shall, similar to the plans regarding modernisation and new construction stated by the "Economic Commission for Europe (ECE)" by order of the „Economic and Social Council of the United Nations“ or the "Conference of the European Transport Ministers (CEMT)", develop supraregional plans for renewal, modernisation and new construction of railway lines in addition to the defined TRACECA programme. These plans shall also include statements on the admissible free-running speeds to be aimed at. (See Annex 3.1.)

Long-haul traffic on the corridors

Where parts of the national territory can only be reached via the national territory of another country, the present situation of traffic handling is not satisfactory.

An introduction of long-haul traffic on the corridors as is common in Western Europe may solve this problem to the satisfaction of both parties (see for example between Austria and Italy, Austria and Germany).
The basis for the creation of corridors shall form a treaty concluded by the countries concerned. The treaty shall govern the infrastructure user fees, the allocation of tracks to the corridor and the liabilities in case of damage to the network, rolling stock, the property of the passengers or to the transported goods.

Trains circulating via these "corridors" should not have stops for passengers or for goods wagons to be side-tracked or taken. Thus, also the stops at the borders for customs and passport control can be dropped.

Since there are no language problems between the train staff and the dispatchers and since there are no differences in the operating methods and signalling and train safety systems, it is not necessary to exchange locomotives and train staff.

An avoidance of long-haul traffic on the corridors by new construction of railway lines as it is planned between Uzbekistan and Turkmenistan should rather not occur out of political reasons, but mainly out of operational and economic considerations.

Rolling stock

All types of rolling stock used by the railways can be freely employed in the whole broad-gauge network (1520 mm).

Maintenance problems regarding rolling stock are due to the lack of spare parts, the problem in purchasing spare parts abroad, the lack of suitably equipped workshops at the railways themselves as well as at private enterprises.

If only the lines are renewed and upgraded, but the rolling stock remains the same, or vice versa, the economic success which can be expected after the improvement of operating methods will not occur.

Thus, also this problem has to be solved.

A co-operation between the workshops that exist at the railways with one another as well as with suitable private enterprises should be started or increased. This co-operation shall be based on a balanced distribution of the maintenance and repair works as well as the production of rolling stock and spare parts.

In order to avoid access capacities as well as unnecessary multiple equipment in the workshops, a modernisation of the mechanical equipment of the existing workshops or the installation of new workshops shall be based on the results of the co-operation agreement.

The well equipped workshops of the Hungarian State Railways, the Austrian Federal Railways and the Netherlands Railways have been organised into autonomous, directly responsible units according to market economy. The services of the workshops for repairs and production are not only offered to the railways but also to other companies. The efficiency of the workshops could be increased by a higher productivity of the machinery and staff.

EDP information systems

The EDP-plans and the employed hardware and software, the application software, the man-machine interface at the information systems and the data bases, as well as the data transmission technology do not correspond to the state of the art.

A restructuring of the central EDP plan into a decentralised plan corresponding to today's state of the art should be started.

The national information systems to be created at the individual railway administrations shall be networked with one another as well as with the data transmission network of the railway administrations of the European Union.

It will also be necessary to adapt the existing application software to a new EDP-plan and to introduce further software products.

When introducing national information systems, it has to be paid attention to the fact that the data transmission protocols and the information to be transmitted have to be compatible.

Such an EDP plan enables on the one side a high degree of independence form other railways and on the other side a better communication between the EDP-system.

A decentralisation reduces the costs for a central computing centre as well as for transactions. Modifications, enlargements of the used hardware and application software as well as the introduction of new hardware and application software products will be possible (flexible) also without agreement by the other railway organisations.

The EDP systems for the passenger and freight traffic installed at the European Railways are basically national installations. For the international traffic the national systems are connected by the data transmission network called „HERMES".

3.1.2 Operating methods

Co-ordination and admission of journeys

The central dispatcher co-ordinates, supervises and admits the journeys in his section. He co-ordinates journeys beyond his section with the central dispatcher of the neighbouring section and, as regards border-crossing journeys, with the central dispatcher of the neighbouring railway administration.

The types of co-ordination, supervision and admission of journeys at the Central Asian Railway Administrations is proven and also corresponds to the trends that can be observed at the Western European Railway Administrations.

At the necessary renewal and modernisation of the signalling systems, the existing remote-controlled railway network should be enlarged. In the remote-controlled section, in principle all routes in a railway station or passing loop should be operated by the central dispatcher. A local operation of the turnouts and signals (signalling systems) shall be planned for the handling of shunting operations in the railway stations and passing loops as well as forming a reserve in case of a failure of the remote control.

When for example on the route Mangyshlak - Bejneu the signalling and telecom systems will be modernised then other routes such as Uzen - Mangyshlak, Aktau - Mangyshlak and Russian border - Makat, Makat - Bejneu will have to be modernised as well.
The remote-controlling of the routes in a railway station or passing loop by the central dispatcher in Atyrau enables the reduction of time for the switching and cancellation of routes. Also the time required for the crossing and passing by of trains will be reduced. Through this measure an increase of the capacity of nodes and lines can be achieved.

The central dispatchers that have to operate also the remote-control sections in their areas are supported by the representation of the journeys on a geographical control panel.

The use of computers at the representation of the journeys on the screens as well as the route control by means of mouse and keyboard (e.g. central dispatcher office in Tashkent, Uzbekistan), supplemented with the indication of train number, the deviation of journeys from schedule, constitutes a further improvement of the co-ordination of the journeys. The stored information regarding the type of the journeys, their deviations from schedule (also that of the freight trains) including location and reason for the deviation from schedule, forms an important basis for operating measures and the planning of the time-table as regards the improvement of the reliability of train operation, quality of the services and last but not least the utilisation of rolling stock.

The signalling and telecom system, the automatic train control and radio communication with trains shall be upgraded, in order to reduce the fault liability of the existing systems and thus minimise maintenance costs and improve safety and reliability. It is recommended to also use automatic train control and radio communication with trains at other lines.

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The reduction of the failure frequency of these systems will decrease the maintenance costs up to 20 %, reduce the late arrivals of trains, improve the operations safety and the competition.

Passenger trains

In order to offer an alternative to air traffic as well as an improvement of the competition with road traffic, in national and international (interstate) passenger traffic the journey times should be reduced as soon as possible and the creation of traffic according to the Basic Interval Timetable (see Annex 4.1.2.1) should be striven for as long-term objective.

If the average commercial speed will be increased from today's 50 - 55 km/h to 100 km/h by an improvement of the track condition and the rolling stock, a reduction of the travelling times will be possible. In case of a reasonable departure time in the originating station (e.g. Akmola 18.00 departure and arrival in Almaty 8.00), this travelling time makes possible an optimum utilisation of the time at the destination.

An increase of the maximum speed on the line to 160 km/h would not necessitate any major changes to the alignment of the track, it would, however, reduce the travelling time considerably.

Table: Possible travel times for Almaty - Akmola (1,350 km)

vmax 100 km/h	14 hours
vmax 140 km/h	10 hours
vmax 160 km/h	9 hours

The use of trains with tilting bodies (such as the Pendolino in Italy, Talgo in Spain, Germany Sweden) reduces the travelling time considerably (25 - 30 %). Prior to a decision regarding the use of this technology, the costs for the time-consuming maintenance works for such a type of rolling stock as well as the extensions of the railway installations and lines before the curves have to be compared with the costs for the extension of the radii with the curves for higher speeds.

Prior to a fundamental change of the existing operating methods, the necessary technical outline conditions (increase of running speed, the employment of the rolling stock for higher speeds) have to be created and a detailed study on the existing and future private and business travelling habits of the people has to form the basis for the implementation of new operating methods.

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Freight trains

The national and international (interstate) market demands short transportation times, a flexible handling and absolute reliability at a competitive price/performance ratio as well as market orientation including benefit to the customer, especially including permanent information on his transports.

The presently used system is not suited for the future requirements of the economy and the consumers.

These requirements can be achieved, if in the transport chain
- the house-to-house transportation times are minimised by an increase of the speed of freight trains up to vmax 100 km/h and by a drastic reduction of the stopping times of the wagons in the marshalling yards,
- train formation is concentrated in a few well-equipped marshalling yards,
- the transportation offers are guaranteed

The basis for all activities forms a study on the transportation habits of possible customers, expected relations needing transportation, the survey of the possible volume of transportation and the required quality criteria.

The transportation methods at European railways range from a deliver without date term to just-in-time delivery.

Apart from the basic offer

- **delivery of goods within 36 hours -> start of transportation in the afternoon or evening of day 1,**
  -> provision in the morning of day 3

and the quality offer

- **delivery of goods within 12 hours -> transportation during the night,**

casual traffic, block trains, unit trains as well as just-in-time transportation are recommended to be introduced for the satisfaction of the customers' desires and for minimisation of costs (Annex 3.2.).

The concentration of shunting operations in high-capacity, well-equipped marshalling yards reduces shunting expenditure and damage frequency and makes possible to circulate trains over long distances without shunting operations.

It is therefore recommended to analyse the optimum number of marshalling yards and the most suitable locations, the implementation of new train formation concepts and the economic evaluation in a separate study.

Single-wagon traffic, unit and block train offers as well as monitoring of consignments including corresponding information of the customer in case of deviations from the transportation plan have to be taken into consideration.

The transportation quality is guaranteed by the regular train service, by priority listing of train types, the consequent supervision of the transport chains (list of trains with which the wagons are transported from the dispatching station to the destination station) and a corresponding information of the customer in case of deviations from the transport chains.

To be able to guarantee the determined running time, it is necessary to consider especially closing times for loading and times of provision of wagons in dispatching and receiving points already in the planning phase. In order to avoid remaining freight, the last train of a destination must not be left out and will be planned with light composition. A detailed analysis of traffic streams between the marshalling yards having the highest capacity, the composition of the trains offered in the individual relations, the volume of freight in the loading areas as well as freight allocation and proceedings of freight handling in terms of time serve as basis for the planning.

Annex 3.3 shows organisation and planning of national and international freight traffic by the example of the procedures applied at the Austrian Federal Railways and many European railway organisations.

3.1.3 Train configuration and marshalling procedures

Passenger trains

At the annual timetable conference of all countries of the former Soviet Union, for trains of international (interstate) traffic, the number of wagons, the types of wagons, the position of the wagons in the train and the fact with which train(s) the wagons are returned to the originating station is agreed.

As regards national traffic, the number of wagons, the types of wagons, the position of the wagons in the train and the fact with which train(s) the wagons are returned to the originating station is determined on a national level.

Apart from a detailed study on the number of passengers to be expected per route, it is also necessary to consider the actually transported number of persons per train and class of wagons between pre-determined stops. This procedure constitutes an important prerequisite for an efficient and economic use of the rolling stock.

In principle, a train set is not split up during an agreed time-table period. Only in case of repairs that cannot be done during the turnaround time of a train in the destination station of a run of a train or wagon, or if a wagon is out of running order in an intermediate station, these wagons are taken out and replaced. The turnaround time of a train set may last between a couple of hours and a couple of days.

In order to be able to improve the economic efficiency of the (own) rolling stock, a reduction in standstills of a train set or at least of some wagons thereof is to be striven for through using them in further runs of trains (Annex 3.5).

A prerequisite constitutes an improved state of repair of the rolling stock to avoid frequency of breakdowns, the increase of the average commercial speed from presently about 50-60 km/h to 80-90 km/h or more, the exact observance of cleaning and shunting times as well as the improvement of punctuality of trains.

In case of distances of up to 500 km, the shorter travelling times make possible to circulate trains also during daytime, and thus further improve economic efficiency of the rolling stock used.

If the planned turn round of rolling stock is strictly kept and if, already when planning the formation of the wagons within the train, their usage in another train is considered, these measures will prove to be efficient, even if shunting expenditure will be higher.

It is recommended to analyse the market conditions for passenger traffic in detail in order to elaborate a customer oriented and commercial train service.

Freight trains

Standards regarding train formation for national traffic and for exportation and importation are available. A train formation concept which allows a train configuration beyond one or several marshalling yards, however, is not common.

It is recommended to introduce the train formation plan for national and international freight traffic, applied at the railway organisations of the European Union and many East European railway organisations. Details are presented in Annex 3.6

Within the framework of an annual conference of the European railway organisations (FTE, Forum Train Europe), the transport chains being necessary for an efficient and economic international traffic which corresponds to the customer requirements are determined as source > destination relations. Connections schedules for individual trains result which determine for which destination stations wagons are classified in a train, and at what position within the train wagon groups have to be put.

3.1.4 Operating control

At the railway organisations under consideration, operating control is done in different ways. At all railway organisations the idea of newly arranging the internal organisation of the enterprise can be seen. Operating control does not make an exception.

Most of the railway organisations within the European Union organise operating control in the business unit "Infrastructure or Permanent Way", which makes it independent of the

business unit "Operations" in which passenger and freight traffic as well as traction are organised.

The task of operating control is to guarantee in the form of a "Quality Management" the maintaining of the quality parameters in passenger and freight traffic as agreed with the business unit "Operations" and to provide for an economic working that corresponds to the aspects of customer service.

The central dispatcher offices being the co-ordinators and having to agree to all journeys are actively involved in traffic planning and execution, and thus they alone cannot be an efficient instrument of traffic control.

An efficient quality management

a) co-ordinates track and signalling installation renewal and maintenance actions, so that resulting longer travelling times can be absorbed by the time margins contained in the time-table.
b) sets actions ("control") in case of extraordinary events in train traffic (e.g. derailments), so that the consequences on the reliability and punctuality of the trains remain as low as possible.
c) sets actions in case of deviations from the planned operation (for train formation as well as running of trains) ("supervision and control"), so that the consequences on the reliability and punctuality of the trains remain as low as possible.

It is recommended to introduce a quality management similar to the European models.

Annex 3.3 shows a chart of quality management normally used at European railway organisations.

3.1.5 Timetable planning

There is no sufficient orientation towards the requirements of the passenger and freight traffic market as regards train offers. The function of the orderer of a service (e.g. time table route of trains) cannot be clearly seen in the railway organisations' charts. The running of trains offered, the train positioning within the time-table and the number of trains per relation do not constitute the result of a valid market analysis. For an economic success of the train offer, the acceptance of an offer by the customer is decisive.

In order to reach the highest possible acceptance of offers, it is recommended to elaborate an offer plan ("marketing plan") being based on national market surveys for the national and international (interstate) passenger and freight traffic which considers economic aspects. The adaptation of the marketing plan to international (interstate) connections is possible within the framework of the existing bodies in "OSShD".

In case of the European railway organisations, the elaboration of a marketing plan is the task of the orderer and not directly the task of time-table planning. The requirements stated in the marketing plan, however, constitute the starting point for a time-table planning that fulfils the customers' requirements.

The tasks of the body being responsible for the adaptation of international (interstate) passenger traffic should be extended by the task to adapt also international (interstate) freight traffic (see Annex 3.6 task and target of the UIC body "Forum Train Europe, FTE").

3.1.6 International co-operation

Co-ordination of freight and passenger time-table on each side of the border

Passenger traffic

As regards international (interstate) passenger traffic, the arrival and departure times at the interchange stations are agreed upon by the railway organisations affected by the running of trains at a conference on the "Consultation on the Harmonisation of the Train Timetable with the Neighbouring Railway Administrations (WMPS)" taking place in Moscow within the framework of the OSShD.

A close co-operation regarding international (interstate) passenger traffic is already existing.

Freight traffic

The wagon distribution plan presently existing for border-crossing freight traffic (trains are only run to the next marshalling yard) gets along with bilateral agreements. A plan which also includes transit freight trains needs multilateral agreements. Thus, it is possible to considerably shorten transportation times between the dispatching office and the destination - also in single-wagon traffic. Thereby, competitiveness will be improved and thus also the economic situation of the railway organisations will be influenced in a positive way.

It is recommended to establish a service concept of direct connections of freight trains between the commercial centres of the region and Europe within the framework of the OSShD.

In order to avoid additional costs, the body existing for the adaptation of international (interstate) passenger traffic (WMPS) should also take over the same task for international (interstate) freight traffic.

The exchange of rolling stock, including technical inspections

Passenger traffic

Border handling of passenger trains is done in agreed railway stations being near the border. Here, technical take-over inspections are done, locomotives and train staff are changed, the documents required for wagon take-over are prepared and the necessary electronic data processing work is carried out.

The stopping times largely depend on the number of passengers getting into and out of the trains as well as the amount of luggage transported.

A decisive reduction of stopping times at borders can only be reached if, apart from the changing of locomotives and train staff as well as the technical take-over inspections of the rolling stock, also passport and customs control can be omitted.

It is recommended to propose to the Customs and Border Control Authorities to perform the controls in the running trains.

As regards border-crossing long-distance traffic of locomotives and train staff, there are no technical, operational or language problems, as they do exist at European railway organisations.

The reduction of inspections regarding the running order of the rolling stock to the extent being common at European railway organisations, namely one inspection after 24 hours of travelling time, will reduce costs without limiting operational safety.

However, a prerequisite for this is a good state of repair of the rolling stock and an agreement with the respective railway organisations on a mutual trust inspection system as is common practise at European railway organisations. Apart from the technical parameters a vehicle has to fulfil, this agreement regulates also liability questions in case of damage.

Agreements regarding the equal exchange of locomotive and train staff performances can quickly be realised if the railway organisations concerned show their good will. The economic utilisation of the existing resources will be enormously improved.

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Freight traffic

Border handling of freight trains is done in agreed marshalling yards being in the vicinity of the border together by the respective railway organisations. Here, technical take-over inspections are done, locomotives and train staff are changed, the documents required for wagon take-over are prepared and the necessary electronic data processing work for the settlement of hire charges for wagons is carried out.

In general, stopping times depend on the times needed for necessary train formation works, technical inspections, commercial border handling of consignment notes as well as the time needed for the preparation of the documents for wagon take-over and the electronic data processing work regarding the settlement of hire charges for wagons.

The time expenditure being necessary for these works is very much less than the time expenditure needed for customs control.

A decisive reduction of stopping times at borders can only be reached if, apart from the changing of locomotives and train staff, also customs control directly at the border can be omitted.

As regards border-crossing long-distance traffic of locomotives and train staff, there are no technical, operational or language problems, as they do exist at European railway organisations. Only technical standards regarding the maximum time in use between the individual inspections or overhauls of the locomotives and the mileage of goods wagons without technical inspection of running order as well as the standards regarding the maximum working hours of personnel have to be applied as limitations of employment.

The reduction of inspections regarding the running order of the goods wagons to the extent being common at European railway organisations will reduce costs without limiting operational safety. The inspection of the running order of a goods wagon is only done prior to the next use (empty or loaded wagon). It would even be possible to circulate wagons for up to 1500 km or more without technical inspection.

However, a prerequisite for this is a good state of repair of the rolling stock and an agreement with the respective railway organisations on a mutual trust inspection system as is common practice at European railway organisations. Apart from the technical parameters a vehicle has to fulfil, this agreement regulates also liability questions in case of damage.

Agreements regarding the equal exchange of locomotive and train staff performances can quickly be realised if the railway organisation concerned show their good will. The economic utilisation of the existing resources will be improved to an important extent.

It is recommended to analyse for each of the border stations the length of stops, to eliminate double works, to introduce the technical take-over inspection of rolling stock, the commercial border handling of freight documents, the preparation of the documents required for the wagon take-over and the necessary electronic data

processing work for the settlement of hire changes for wagons based on the division of labour.

3.1.7 Short-term programme - improvements of train schedules

In the following a proposal made by the Consultant is given for an improvement of the transport offer by means of two pilot projects which may be executed within 3 years at most.

Pilot project N° 1

Passenger traffic: Kazakstan

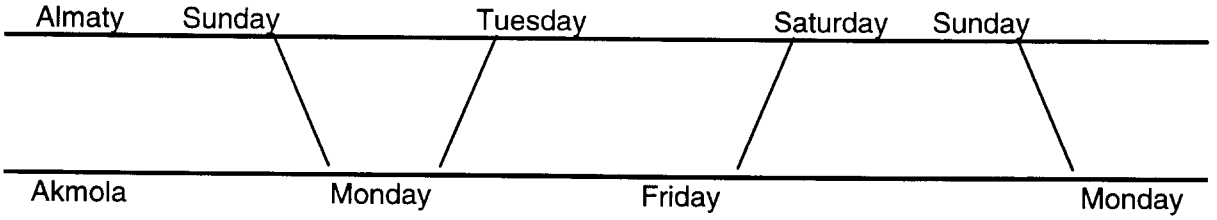
The shifting of the offices and authorities from Almaty to Akmola - the new capital - should lead to the construction of a direct connection between Almaty and Akmola in addition to the existing offer.

It is recommended to create a connection Almaty - Akmola - Almaty which will be offered two times a week.

This offer ("The flying Kazakh") which is meant to be a competitor to domestic flight traffic and is planned without intermediate stop, shall need 12 hours for this distance. 08:00 should be planned as time of arrival in Akmola and Almaty respectively, and 20:00 as time of departure. Thus, there are 12 hours for handling of affairs in the new capital.

A train configuration for only 170 passengers comprising 2 „Luxus"-sleeping coaches, 1 dining-coach, 1 „Coupe" sleeping coach, 1 coach with seat reservation, creates the technical prerequisite that the necessary running speed of 110 km/h can be reached without major changes of the permanent way and without a dangerous overload of the engines of the locomotives.

The following days of train service should be offered:



The tariff could be similar to air fares (the price for a return ticket from Almaty to Akmola by airplane was US $ 230.- in 1996) and include dinner and breakfast.

With an average price for a return ticket of US $ 100 including dinner and breakfast and a utility rate of 70 %, revenues of USD 11,900 per train can be calculated.

Because there are no indications by the railway administration on the present costs of a train kilometre or a passenger kilometre, a benefit calculation is presently not feasible. A comparison with the costs of an air ticket, however, shows that such a train connection would be accepted by the customers.

An economic feasibility of this proposal has to be proved in a separate study including market analysis (benefit) and cost analysis.

The introduction of such a train connection shall be prepared by advertising in newspapers, magazines, TV and radio.

The practical feasibility of this proposal could be proved by means of a trial run which would show weak points (track, track bed, rolling stock, operating control) which have to be removed.

Pilot project N° 2

Freight traffic: Kazakstan, Kyrgyzstan, Uzbekistan, Tadjikistan, Turkmenistan

It is recommended to investigate in detail and introduce during a pilot project, the direct connections for single wagons or set of wagons, especially with consignments of combined traffic (container)

- **from and to Russia via Kandagach (Kazakstan) or**
- **from and to Western Europe via Turkmenbashy (Turkmenistan) / Baku (Azerbaijan) and/or Tedschen (Turkmenistan) / Sarakhs, Meshed (Iran).**

This pilot project can be seen as part of the proof of the practical feasibility of the "agreement on organisational and operational aspects of combined full-load traffic between Europe and Asia" (XXIV. session of the ministerial conference of OSShD, June 1996) which is being prepared as well as the „Ashgabat Declaration on the development of transport and communication infrastructure and network of transnational pipelines in the ECO Region", endorsed by the Head of States on an extraordinary summit meeting in Ashgabat, Turkmenistan in May 1997. It also fits into the plan of a corridor Drushba / Western Europe initiated at the session of the "Pan European Transport Conference" of the Ministers of Transport (March 14 to 16, 1994, Crete, follow up in Budapest, February 1, 1996) as is also included in the "European Agreement on important international combined transport lines and related installations" AGTC - network.

Details regarding the proposal see Annex 3.1.

3.1.8 Long-term improvement programme

As accelerated renewal and upgrading of infrastructure installations, rolling stock and computer support constitutes the prerequisite for an introduction of new transportation offers adjusted to customer requirements as well as a lasting improvement of the transportation

quality and an optimisation of operating control which directly influences the financial situation of the railway organisations.

A precondition for an accelerated renewal programme is the termination of the present import dependence on necessary spare parts for maintenance and renewal of rolling stock, technical installations and equipment, computer systems as well as permanent way material.

After a corresponding change of legal requirements and after having modernised the technical equipment, it is recommended to develop/organise the existing repair workshops into units for the production of necessary spare parts and for maintenance and renewal of rolling stock, telecommunications and signalling installations.

The changes of the legal requirements should make possible that the railway organisations can

- enter into a co-operation of their workshops with one another, in order to create a co-operation based on the division of labour. A just distribution of the tasks between the workshops as well as fair prices for the produced spare parts constitute a prerequisite.
- transform the workshops into a common, independent enterprise. The railway organisations still are the proprietors of this enterprise. Their shares in profit or loss of this enterprise correspond to the value of the workshops brought in, of the production material as well as the amount of their financial contributions to the enterprise.
- manage the existing workshops as independent subsidiaries of the respective railway organisation. These independent enterprises shall be able to enter into co-operation with subsidiaries of other railway organisations, with state-owned or private telecommunication companies or with private companies producing or needing spare parts for machines, technical installations and equipment (for heavy building machinery, mining and petroleum or gas exploitation), and they should be free to enter into joint ventures with foreign companies.
- transform the existing workshops into independent enterprises. These enterprises shall be able to enter into co-operation with subsidiaries of other railway organisations, with state-owned or private telecommunication companies or with private companies producing or needing spare parts for machines, technical installations and equipment (for heavy building machinery, mining and petroleum or gas exploitation), be free to enter into joint ventures with foreign companies as well as be able to merge into multinational enterprises. The railway organisations can act as proprietor of the whole enterprise or as shareholder of the enterprise.
- enter into co-operation with companies producing permanent way material or found such enterprises. Possibly missing know-how shall be brought in through joint ventures with foreign companies.

The decision in favour of one of these solutions will reduce the import dependence. In case of imports of new, modern rolling stock, technical installations and equipment, computer systems as well as permanent way material, the value added will be clearly increased through taking over different tasks in the fields of manufacture and maintenance.

These proposals correspond to the trend existing at the European railway organisations to physically or organisationally separate the key functions of the enterprise from service functions.

Infrastructure installations

In a separate study, the details of the necessary renewal and modernisation on the lines and track sections of the TRACECA, CEMT, ECO routes and those routes necessary for covering the domestic demand shall be elaborated. For those lines or parts of lines the renewal and modernisation of which proved to be efficient, a priority plan including the corresponding funding proposal shall be prepared.
The following table indicates the lengths of lines and track sections which are proposed by TRACECA, CEMT and ECO as well as by national experts for renewal and modernisation as regards freight traffic.

	length in km
TRACECA, CEMT, ECO, National	
(Kazakstan) Arys - Almaty - Aktogay - Druzhba (China)	1,619
TRACECA and ECO	
(Kazakstan) - Arys - (Uzbekistan) - Tashkent - Bukhara (Turkmenistan) - Farab - Tedzen	1,180
TRACECA, CEMT and national	
(Kazakstan) - Kandagash - Arys	1,333
TRACECA and national	
(Kazakstan) Aktau - Makat - Kandagsh	1,030
(Kazakstan) Lugovaja - (Kyrgyzstan) - Bishkek - Balychi	322
(Uzbekistan) Sariassaja - (Tadjikistan) - Dushanbe	80
(Uzbekistan) Amusant - (Tadjikistan) - Kurgan Tuba - Kulab	231
(Uzbekistan) Bekabad - (Tadjikistan) - Kanibadam	99
CEMT and national	
(Russia) Uralsk - Aktubinsk - Kandagash	639
(Russia) Tobol - Akmola - Mointy - Aktogay	1,692
total length	8,285

Given the presently available technical resources, a renewal of the total length of 8,285 km would last 1,657 months. If modern technology and a well-co-ordinated team is employed, the time spent could be reduced by 50 %, to probably 829 months.

As regards passenger traffic, the market demand for connecting routes between the capitals of the TRACECA-countries and the regional capitals of these countries as well as the

capitals and regional capitals of the neighbouring countries shall be determined in a separate study. Based on these results, the corresponding offers shall be prepared and renewal and modernisation co-ordinated with the passenger traffic demand.

This renewal and modernisation shall be realised gradually according to priority plans and financial commitments.

Phase 1:

Task:

Renewal and upgrading of through and main tracks including bridges and culverts on the most important domestic routes as well as the lines used for export and transit traffic, so that the originally planned speed can be achieved. Completion of already started upgrading work and new construction of lines.

Prerequisite:

The priority plan and the consequences on operation have to be co-ordinated with the respective railway administrations; financing is secured.

Method:

In general, mechanically, however, also a cost-advantageous combination from mechanical and manual track maintenance will lead to the necessary quality.

Task:
Renewal of signalling installations, systems for radio communication with trains, automatic train control systems, remote control systems as well as systems for roll-over control and breaking of the rolling wagons in marshalling yards.

Improvement of the state of the art and renewal of the technical installations

Prerequisite:

The priority plan and the consequences on operation have to be co-ordinated with the respective railway administrations; financing is secured.

Phase 2:

Task:
Increase of speed

Increase of speed on selected routes to a speed corresponding to market requirements. New construction of the sections or part of sections serving for the improvement of the transportation offer and the optimisation of operating control.

Extension and reconstruction of lines or track sections which serve for an amelioration of the transportation offer in passenger and freight traffic as well as optimisation of operation.

The following table indicates the railway's plans:

country / line	extension	reconstruction
Kazakstan		
Zhezkazgan - Kzyl-Orda	for freight transit traffic	
Uzen - Turkmenistan	transit traffic	
Almaty - Chu		electrification, second track
Almaty - Chu - Akmola		for 140 km/h
Kyrgyzstan		
Uzbekistan - Osh - China	international traffic	
Uzbekistan		
TRACECA - Route		electrification
Fergana-Valley - Osh - China	international traffic	
Nukus - Uchkuduk	raw material, supplement for corridor	
Angren - Uchgurgan	supplement for corridor	
Guzar - Kumgurgan - (Termez)	supplement for corridor	
Turkmenistan		

Tahiatis - Gaznajik - Iran	transit route	
Chardzhev - Kerki	connection of the region	

Task:

Introduction of new operating control methods

Introduction of new automatic train control systems, modernisation and extension of remote control.

Prerequisite:

A concluded market survey shall show the profitability of a transportation offer with shorter travelling times and that the realisation of such offers will only be useful by using a new operation method.

Rolling stock

Phase 1:

Tasks:

Calculation of the number of locomotives being necessary until the year 2005 for covering the transportation offers being adapted to customer requirements as well as the number and type of passenger coaches and goods wagons. Investigations whether this demand can be covered by the existing rolling stock.
Refurbishment of rolling stock.

In case of goods wagons, the creation of a privately organised pool of rolling stock being the property of the railway organisations concerned is recommended.

Unlike the "EUROP-Pool" of the European railway organisations, this fleet should be organised as "leasing company". The rolling stock will be made available against fees for using according to time and mileage. No hire charges will be charged for the railway networks of the railway organisations participating in the fleet. A return of empty wagons to the proprietary railway organisation no longer will be necessary. Maintenance and repair work regarding rolling stock, repayment rates for credits taken up for the purchase of new rolling stock as well as administration costs will be paid out of the fees for using.

Prerequisite:

The legal requirements have to be changed accordingly. The railway organisations agree to this proposal.

Benefit:

The railway organisations participating in the pool do not charge a wagon hire. It is no longer necessary to send empty wagons back to the owning railway administration. Renewal and modernisation of vehicles, repayment rates for credits taken for the purchase of new vehicles as well as the costs for the management of the enterprise are covered by the user fees.

Phase 2:

Task:

Enlargement of the pool by passenger coaches and tractive units.

Transportation services

Passenger traffic

Installation of systems for the information of passengers (customer information)

In the train:

about the imminent arrival at the next station, the connection trains and, in case of missing the connection train, the next possible connections.

At the station, at home and in the office:

about the arrival and departure times of trains, delays and cancellation of trains and about tariffs.

Freight traffic

Installation of systems for the information of customers about the transportation offer, the expected transportation period and the costs of transportation.

Benefit:

The customers' acceptance of the transportation services will be increased and the competitive position will be improved.

Computer support

As proposed, the necessary modernisation should be used for a decentralisation of the existing systems. This does not mean a total dissolution of the existing computer centre in Moscow, but rather a distribution of the tasks which do not necessarily have to be done in a

central system to national systems and an extension of the national computer support to more departments of the railway administrations.

The decentralisation does not constitute the urgent subject and can only be done by mutual agreement between the railway organisations and the "computer centre". It has to be agreed upon which applications can be hived off in what way and in what period of time.

Apart from the renewal and modernisation of the existing hardware and the introduction of modern operation and application software, the data transmission networks will have to be modernised.

Annexes 3.7 and 3.8. present an outline of a possible networking of the national EDP-systems of the railway organisations with the "computer centre", other railway organisations of the former USSR and the data network of European railway organisations as well as the departments of one railway organisation with one another.

Annex 3.9 presents the departments of the railway organisations which are suited for a technical computer support and how these departments depend on and complement one another.
The gradual decentralisation shall be made for new applications which are exclusively used by the respective railway organisation.

It is recommended to realise the following items within the departments Production and Infrastructure Planning, Operation Control, Quality Management / Controlling and Customer Information:

Decision Support Systems for railway processes, an integrated, open, modular, homogeneous management system consisting of:
- Route Management Systems,
- Resource Management and Optimisation Systems

Operating Control Systems

Cost Centre Accounting
An instrument for the exact calculation of the costs of railway administrations in all departments serving as basis for an economic evaluation of the investments to be made and the costs for operation control as well as the identification of potential savings.

Systems for the Information of Customers
- about the expected transportation periods from the place of dispatch to the destination
- about the expected costs of the transportation service

The commercial benefits out of theses measures shall be evaluated by a separate study. The different situation of the railway companies on the TRACECA-route and in Europe does not allow the simple transfer of the benefits achieved at European railways to the railways in the region.

3.2 Recommendation for Commercial Performance Improvement

In general terms, we can say that the organisation, operations and commercial tools are mostly old fashioned. But this in itself does not explain the poor performances shown by the railways in Central Asia. Of course, few tasks are automated or computerised, and most are labour consuming. But this is not necessarily a negative aspect in countries where labour is extremely cheap and available. In fact there are many examples of very efficient railways, not to speak of other industries, using traditional methods and retaining their customers.

Of course, modern computerised reservation systems allow for yield management and revenue optimisation, but such results may be of no value and interest under local conditions where fares are regulated by the government and may be increased by 50 % or 100 % from one day to the next. Automatic marshalling yards can be built to replace mainly manual yards as they operate now, but is this reasonable when large stations, where 3000 wagons were once sorted every day (and even more according to official numbers), but only see 1000 nowadays? On many occasions we observed Personal Computers unused on top of file chests, which suggest a poorly conceived and badly managed computerisation, indicating that much money has been wasted purely for the sake of artificial modernisation.

A revolution is needed in the minds of the railwaymen, and particularly in the high ranking staff, to persuade them that a new war has begun, and that by retaining the old way of thinking this war will be lost. The customer must be placed at the heart of their reflection and practice. Such a process is not going to take place in a very short period of time. On the other hand competitors are not going to wait to take away the most profitable segment of a shrinking market. Moreover, when the market will hopefully expand again, these new entrants will strongly resist a railway attempting to regain its previous market share. This resistance may even include influencing State decisions about infrastructure choice as well as transportation laws and regulation. When such a situation arises only a railway in a strong position at that point will be able to safely maintain its status, and the main danger that we presently see is the inability of the commercial executives that we have met to even understand this point. We may hope that the study visit to Western Europe undertaken by certain members of the staff concerned will prove useful in accentuating this point in the coming months.

In general, the existing regulations are very close to what can be expected from a railway working with the old methods previously mentioned. The problem, however, is not so much their existence but rather the respect for them. As an example, the requirement for minimum distance travelled per day is set at 200 km for standard freight and 300 km for fast freight loaded in single wagon, which are exactly the speeds in application on the western railways during the 1970's. Although this figure may seem low, the fact must be taken into account that wagons go through marshalling yards frequently to change trains, a process which in general takes several hours. In addition, this is a legal minimum to support claims. The real railway world is, nonetheless, supposed to perform better. Unfortunately, even this low quality goal is often not attained because of the combination of lost time in marshalling yards (less traffic means less long distance trains, therefore more interchanges and longer waiting times for connections) and in cross-border operations. In addition, the braking of wagons

coming down the hump is entirely manual and leads to many shocks and damage to the loads.

From a purely commercial point of view, and because of difficulties at times in understanding the various procedures a consignor had to go through to make a shipment, we asked the question in the following form:

"We have in our shed 40 tons of cotton that we want to send to (....Moscow, ...city in another country of central Asia, or .... city in the country). What should we do?"

It was interesting to note how difficult the question seemed in certain cases. It was even more difficult when in answer to the question we obtained the response: "Contact an expeditor" and we insisted to negotiate directly with the railway company. Answers, if at all, varied considerably depending on the counterpart we were speaking with, as well as on the fictitious loads and transportation conditions. It is clear that the expeditors are playing the role of a sales force for the railways, but in the first instance they are playing that role mainly for their own benefit, and secondly they are building a screen between the railways and their customers that prevents the railways from quick and efficient responses to the wishes of the customer.

Under these conditions, we do not see much possible room for improvement, other than organisational, that can be achieved by the railways themselves, without the help of foreign investors ready to take reasonable risks in specialised transportation. It would appear possible to negotiate the organisation of daily or semi-weekly freight trains carrying wagons of high value goods from and to the main economic centres, taking the best available rolling stock and having a special organisation to provide locomotives and drivers. The performance does not have to be very productive, but has to be guaranteed. Surely cotton, general goods in containers, cars [6], high value agricultural products such as tobacco, aluminium, electromechanical parts, are the basis for such train loads heading for the harbours of the Caspian Sea, Russian Railways or the border with Iran. Other sources of very different potential traffic are ore and gas and petroleum. Central Asia possesses the most important reserves of petrol and gas after the Persian Gulf region and will surely be among the leading regions of production in the next century. Running very heavy trains through the region is a challenge with which these railways have been familiar in the past, and we understand that the main problem is the availability of specialised wagons. It is likely that a stable economic situation will encourage investors to assist in the fabrication or acquiring of such rolling stock, thereby providing the means for such regular and heavy traffic which will then become an important factor in railway renewal.

More practically, railways must simplify and clarify their relationship with their customers, and clearly put commercial concerns first rather than technical performance. Customers must not be required to ask for their wagons up to a month (we were even told 45 days in Uzbekistan) in advance (not because of lack of rolling stock, but simply through the application of old

[6] Several plants for car and lorry manufacturing are projected in Central Asia; Daimler-Benz and Daewoo have built the first one in Uzbekistan. Currently, new cars are transported by rail to their delivery point, and this traffic represents an important part of Western Railways' business.

rules and hyper-centralised procedures). Transportation plans should be established locally in each country, together with their neighbours, but independently of the "Moscow scientists". This does not require exceptional skills and/or equipment, contrary to what the local people seem to think. It even can be done without any computerised systems and still be of high quality, especially considering the type and the level of traffic presently encountered by the railways. This transportation plan must be flexible, and able to be adapted quickly to customers' needs, changes or requests.

The Railways must furthermore simplify internal procedures. For example, the way the documentation attached to each wagon is carried remained long a mystery[7]. The complication of the procedures made it difficult to explain and to understand clearly the methodology. It was only after visiting several marshalling yards and stations that we could be sure to get the right answer. It may seem a small problem, except that a wagon must always wait for its documentation before it can join a train. Poor organisation of the sorting and physical movement of documents in a marshalling yard can easily lengthen connection times or delay trains. This is also a case where computerisation may help, making the transport of such papers redundant, or at least making it independent of the movement of the wagon. It seems to the consultant that the freight computer system already may have the necessary information, and that it is more a question of organisation, and maybe of the quality of the information, to attain this goal.

Official tariffs and their rules of application must be easily accessible to customers, and railway companies must retain the possibility of negotiating themselves any fare reduction and special conditions with customers. Especially for new plants and industry, private siding construction must be encouraged as well as private rolling stock acquisition. Such measures link industry far closer to a railway, through the investment involved, than any other method. Long term agreements, based on these investments and on guaranteed traffic and performance will further enhance this relationship. The use of the wagon localisation system, which we have seen working and is apparently functioning very well must be encouraged, perhaps through cheaper fares (7 dollars per enquiry seems very high when the local economic conditions are taken into account).

For passengers, simplification, transparency and information should be the rules. Of course, better rolling stock running faster on better track will bring new customers, but at a high cost and only in the medium or long term. Information on fares and schedules, access to stations, ticket purchasing, access to trains, ticket inspection, etc., must all be rethought with passenger comfort and satisfaction in mind, at less cost for the company. Observation of the present situation showed us that there is much to do in this field.

A more open fare reduction system must be put in place, together with a cost evaluation system, in order to try to bring back passengers, through elasticity of tariffs, from coaches to trains,. A further solution may also be to allow outside companies to invest in rolling stock and carry passengers at their own financial risk. In such a case however, much attention must be paid to the contract for traction and use of the infrastructure to make such an

[7] *Commercial, technical and customs information, is contained in a set of papers that must travel along with the wagon. Weather conditions, length of trip, security, etc. do not allow them to be put in a box on the wagon itself.*

arrangement beneficial to the railway. Otherwise there is the risk that the newcomer may take the cream of the traffic and leave only the low revenue operations to the railway.

It must also be kept in mind that passengers are extremely sensitive to trip time, even in those countries where marketing concepts are not yet widespread, and that presently the competition is in general providing a better performance than the railways. Modern and comfortable coaches (mostly second-hand from Western Europe) departing regularly and running faster on improving roads become quickly more attractive to customers than daily night trains, dirty and noisy, and in addition slow. Trip times can be improved by heavy investments in rolling stock or infrastructure, but they also can be lowered by eliminating useless minutes of waiting time wherever possible. Standing times in stations must be reduced to the minimum compatible with passenger service, with all doors accessible and no ticket inspection to get on board, connections must be organised and managed to reduce interchange time as much as possible. More frequent and lighter trains are more attractive than heavy, infrequent and slow trains. Speed limitations must be checked to make sure that they are necessary, and if they are, followed only where obligatory to minimise loss of time. Drivers must be encouraged to run at prescribed speeds to boost performance. And of course, stopping time at border points must be reduced by all possible means.

3.3 Future Revenue

Priority must be given to setting up computerised management accounting systems in the organisations of all the Railways of the region in order that basic data can be compiled for the establishment of flexible competitive tariffs.

Only in one Railway; that of Uzbekistan, were we told that a new accounting system was being introduced and the system of calculating tariffs being reviewed. Due to time constraints it was not possible to follow up on this information.

Cost accounting systems must be introduced to enable the Railways in the region to ascertain their operating costs for the services which they are providing and thereby the basis for calculating tariffs. These systems must provide information as to how much funds must be generated to cover all the costs which arise; i.e. they must provide for normal operations, normal maintenance and repairs, and generate funds for upgrading and reinvestments.

In order to provide this type of strategic accounting information which can be used for decision-making, it is recommended that an integrated accounting system be introduced which will provide cost data related to the performance of the various services and also detailed unit costs based on recent actual figures for determining tariffs and usage factors.

With the information obtained from the introduction of these management accounting systems the Railways will be in a position to introduce flexible tariffs, which can be readily revised to meet any situation which may arise and enable the Railways to establish and maintain a competitive market position.

Where the results show that a particular service is not able to cover the costs involved a decision must be made to determine whether to increase the tariffs or whether the service in question should be discontinued. If it is considered necessary to continue a service without increasing the tariffs even though that service is operating at a loss, the Railway concerned should obtain subsidies from the government to cover the shortfall in funds generated. This situation is likely to arise for the passenger services where an increase to a realistic level is not feasible since the level of earnings of the users is too low to support higher fares.

3.4 Railway Organisation and Legal Procedures

The question of how much independence the individual railways are to be given needs to be addressed in each of the countries involved. In general it is likely that the governments will need to assume control of the infrastructures and the Railways should be allowed to organise their operations independently of government involvement. This type of arrangement requires a contract between the government and the railways, defining the areas of responsibility and the expected performance of each partner.

In order to provide the information and necessary controls for the recommendations under 4.3 above the railways should be reorganised into business sectors containing profit centres and cost centres. Budgets must be prepared at all these levels and the actual results monitored on a regular basis; preferably at least monthly.

Once these new units have been organised it will be possible to develop cost information in greater detail, so that unit operating costs can be calculated for different product groups and on the various lines. In addition any question of cross-subsidisation from other business units will be clearly evident.

Along with this reorganisation a computerised accounting system should be introduced which will provide the necessary transparency to:

- Provide cost information for the matching of costs against revenues
- Provide the basic data for the calculation of unit costs to establish tariffs

These data would include such items as:

- Unit costs per kilometre for wagon operations
- Unit costs per kilometre for passenger carriage operations
- Unit costs for the operations of locomotives
- The accumulation of cost data pertaining to repair and maintenance services in the various workshops.

These data should furthermore be separated between fixed and variable costs as well as between those pertaining to the operations and those connected with the upkeep of the infrastructure.

With the establishment of this system problem areas can be isolated and those services which are uneconomical can be identified.

In considering the costs involved in operating the Railways of the region the question of overcapacity of facilities, such as repair workshops, should also be looked into. Certain facilities were established with the former Soviet network in view, and are too large for present needs. A review of the facilities should be made to determine to what extent they are fully utilised. Under-utilisation increases the costs involved and thereby sets the tariffs needed to operate efficiently higher than would otherwise be necessary. The possibility of sub-letting some of these facilities for other purposes could provide one solution to this problem.

In addition to the above, further income could be generated by renting out space in railway stations, for shopping, warehousing and similar activities. A further possibility for economies could be in the franchising of catering services on passenger trains.

The decision as to the treatment of uneconomical services should be negotiated with the Government and the services to be provided clearly defined. Subsidies for uneconomical services should then be introduced. These subsidies should at least cover the difference between the tariffs in force and the applicable unit costs.

In the competition between road carriers and the Railway the road user is inevitably at an advantage because he is not required to bear the full burden of the construction and maintenance of highways. The Railway on the other hand must provide and maintain the permanent way, signalling, railway stations, freight yards and other items of infrastructure. Therefore the infrastructure should be separated from the operating departments of the Railways and the costs relating to the provision and upkeep of the infrastructure should be recorded in separate Profit Centres. A decision should then be taken as to which costs can be allocated to the operating profit centres and on which basis. The tariffs to be established would then be based on which costs are to be covered, and the remaining costs which would provide too great a burden for the operations to bear will then need to be covered by Government subsidy along the lines previously described.

Once the system of profit centres and cost centres is functioning it will provide input for calculations of unit costs for the various types of services provided. This will then serve as a basis for the calculation of tariffs and the profitability of the different operations.

The introduction of a viable cost accounting system is therefore essential if the Railway is to meet the challenge of present market conditions and be in a position to confront its competitors.

There is a requirement to further analyse the systems in force with a view to establishing an up to date management accounting system capable of providing the necessary data to establish tariffs and control costs.

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4. Railway Infrastructure in Central Asian TRACECA Countries

4.1 Background and Methodology

In accordance with the Terms of Reference and the Work Plan contained in the Inception and Progress Reports, it was planned to conduct a final mission of the experts formerly involved in Module B to the investigation area. The target of this mission would be the completion and discussion of the prepared recommendations for improvement of both freight and passenger traffic on the TRACECA route. It was scheduled to organise this trip after the Study tour of the local experts in Europe.

As a result of a discussion with the EC Task Manager and the TRACECA Co-ordination Team at the end of February 1997 the consultant was asked to change the approach of the final mission within the framework of Module B.

In accordance with these requirements the mission was carried out with a strong technical and infrastructure orientation instead of the earlier planned commercial and operational orientation. This was done to avoid an overlapping between several other TRACECA projects and to give a general overview of the state of the railway infrastructure in the whole Central Asian area. This overview is necessary to assess bottlenecks in the railway infrastructure in the whole region - and not only on the Aktau - Bejneu line in Kazakstan (Module A) and the Amudarya river crossing in Turkmenistan (Module C) - as well as to define necessary projects and to estimate costs for rehabilitation.

The team of experts executing the infrastructure assessment and analysis mission under Module B consisted of:

Mr Frank Prescha Leader of the group of experts,
Mr Michael Wogowitsch Permanent Way Expert,
Mr Jean-Michel Bertruc Signalling/Telecom Expert.

Taking into consideration the limited time available, the team concentrated its efforts on the main equipment and facilities available for maintenance and repair of equipment in their respective specialities, with recommendations for improvements in organisation and/or purchase of tools and equipment.

It was clearly neither sensible nor possible, given the limited timescale, for the experts to make a thorough investigation of the existing infrastructure or signalling and tele-communications equipment along all the route lines in each country. Thus, the effort was concentrated on the main traffic corridors, especially on the main TRACECA route.

To obtain a full overall picture about the state of the infrastructure in the Central Asian TRACECA countries, the team of experts has included in its assessments and estimations further fields of railway infrastructure such as electrification, incl. power supply, bridges and superstructures.

Accordingly, the aim of this part of the report is to give an overview of the present status of the various equipment and a global estimation of investments required to keep these rail networks at an acceptable level of operation over the next 15 years.

The investigations were based on site visits and technical discussions with local executives for telecommunications, signalling and electrification maintenance as well as for permanent way, bridges and civil engineering in the four countries visited:

- Kyrgyzstan from 13th to 17th of May 1997 - Bishkek,
- Kazakstan on 12 th and from 18th to 24th of May - Almaty,
- Uzbekistan from 25th to 31st of May - Tashkent,
- Turkmenistan from 1st to 7th of June - Ashgabat.

Unfortunately, it was not possible to organise a visit to Tadjikistan for the whole of the experts' team during the limited time of the field mission. A meeting between the leader of the group of experts and the railway executives responsible for signalling and telecommunication, as well as for the infrastructure maintenance department took place at Khodzhent (main station on the Fergana valley North corridor) which gave necessary information about their network, especially about the Fergana valley corridor.

The experts' work on site was prepared and supported by local institutes involved in Module B:

- for Kazakstan the Kazgiprozheldortrans Institute of Almaty,
- for Kyrgyzstanthe scientific and research company NPO Kyrgyzdortranstechnika of Bishkek,
- for Uzbekistanthe company Techvneshtrans, Tashkent branch,
- for Turkmenistan the Turkmenistan Railway's Project and Design Institute "Turkmen-zheldorproject" of Ashgabat.

The above-mentioned local partners were responsible for the provision of basic information (on the basis of earlier prepared questionnaires) for the expatriate experts and were also involved in the logistical organisation of the meetings with the railway executives. They further undertook the organisation of on-site inspections of railway facilities (stations, tracks, signal boxes, CTC centres, permanent way workshops, workshops for maintenance of signalling and telecommunication equipment as well as track machines, local departments for track maintenance and signalling/telecommunication).

The consultant is very grateful to the railway authorities for their excellent support of the experts' work on-site and for the frank discussion of the problems of the railways in the field of infrastructure.

The findings of the experts as well as the first conclusions and recommendations were discussed with the higher railway management:

- in Kyrgyzstan with the Head of the railways, the Chief engineer as well as the heads of the technical departments,

- in Uzbekistan — with the International department responsible for the TRACECA projects as well as heads of technical departments,
- in Turkmenistan — with the Head of the railways, the Deputy Chief engineer as well as all the heads of the technical and operational departments,
- in Kazakstan — the heads of the Kazgiprozheldortrans Institute as well as representatives of technical departments.

4.1.1 General presentation

4.1.1.1 Methodology of the study

This study was based on site visits and technical discussions with local executives for telecommunications, signalling and electrification maintenance in the four countries visited by the Signalling and Telecommunication experts, as well as on information obtained by the leader of the experts group during the visit to Northern Tadjikistan.

The aim of this report is to give an overview of the present status of various equipment and a global estimation of investments required to keep these networks at an acceptable level of operation over the next 15 years.

4.1.1.2 Conventions

All costs and prices are expressed in US Dollars (USD).

The local currencies are:
- Kyrgyzstan Som (KSS)
- Kazakstan Tenge (KZT)
- Uzbekistan Som (UZS)
- Turkmenistan Manat (TMM)

The exchange rates at the 1st of May 1997 are shown in the table below:

	USD	KSS	KZT	UZS	TMM
USD	1	17.5	74.5	60.5	5250
KSS	0.057	1	4.26	3.46	300
KZT	0.013	0.23	1	0.81	70.47
UZS	0.016	0.29	1.23	1	86.77
TMM	0.0002	0.003	0.014	0.011	1

4.1.2 Main equipment characteristics

In the past, the four countries visited were part of the same railway network (FSU network). That means the same operating rules apply everywhere and the signalling and telecommunications equipment is similar. The main difference is only that there are several generations of equipment depending on when installed.

Based on the information given, it appears that these networks have had in the past two main development phases:

- during the 60's and early 70's (around 25/30 years ago) most of the lines were equipped,
- during the 80's (around 10 years ago) part of the main lines and largest stations were renovated.

Later, during the early 90's, the new developments or renovations were kept to a minimum due to the lack of money.

All the equipment is from Russian, Ukrainian and Belorussian suppliers.

In this chapter, the consultant gives a brief description of the principal equipment which is presently installed on the different lines. Detailed figures for each country are given in specific chapters.

4.1.2.1 Signalling equipment

4.1.2.1.1 Operation main figures

Maximum Speed and Speed Restrictions

There are two categories of trains to which maximum speed restrictions apply:

* 100 km/h for passenger trains,
* 80 km/h for freight trains.

On main tracks, a 40 km/h restriction is applied to pass switching points in diverted direction. Due to the condition of the track, some other parts of the line have speed restrictions (for details see chapter 3).

Axle Load and Train Length

The maximum permitted axle load is 23 tonnes.
The normal length of passing and crossing tracks is between 850, 1050 and 1500 m for large stations.

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Train operation

The four networks are equipped with light colour signals, and electric switching points (except for small shunting tracks where they are hand-operated).
In large stations, a single central signal box controls all local train movements.
Part of these networks are equipped with a Centralised Traffic Control system (CTC) and automatic block between stations. In case of centralised command failure, local operation mode is possible in every railway station.
The other lines are operated from local signal boxes located in each railway station, the safety of train movements is ensured by a semi-automatic block system. The train and shunting routes (switching points and signals) are controlled by the local traffic operator of the station.
In principle, all train movements on the lines, at the stations and passing loops are co-ordinated and permitted by central dispatcher offices located in the large stations.

4.1.2.1.2 Station equipment

The railway stations are equipped with two types of Russian signalling equipment:

- before 1978 type with push-button panels,
- after-1978 type with display board and operator command console.

Both of them are using safety-quality relay technology (dating from 1966).

4.1.2.1.3 Block system

The distance between two stations is divided into block sections which do not exceed 2.5 km. On double track sections, for operations on the wrong side of the track, trains run from station to station without intermediate signals.
The railway lines with automatic block systems (stations and open line) are equipped with 50 Hz track circuits (track-release installation). In electrified areas, 25 Hz track circuits are used.
The automatic train running control (frequency impulses) transmits the aspects of the fixed signals to the drivers' cabs through track circuits which are coded.

4.1.2.1.4 Level crossings

All level crossings are equipped with train-operated automatic warning light signals controlled by 1,200 m track circuits on either side of the line. In addition some of these are equipped with automatic barriers.

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4.1.2.1.5 Central Traffic Control

All stations under a CTC section are remote-commanded/controlled from a single central location. Should the remote control fail, the central dispatcher transmits his commands by telephone, which then are executed by the local station operators.

These installations are of four types:

- NEVA type which is the oldest based on industrial relays to send and receive command/control information. The system includes some electronics circuits.
- LUTCH type with electronic cards and relays.
- MINSK type which is more recent and uses only electronic cards.
- DIALOGUE type which is a computerised system with CPU (Central Processor Unit) and VDU monitor (Video Display Units).

4.1.2.1.6 Power supply equipment

Open line signalling equipment (block equipment) is supplied with power via an overhead line all along the railway line with a 3 x 10 kV three-phase feeder and a number of low-voltage auxiliary transformers according to demand. The equipment is secured by means of lead-acid type batteries.

In some sections of the main lines, there are 2 systems, 3 x 10 kV, one on each side of the line (normal and back-up system).

In large stations, signalling equipment is backed by means of diesel generators with lead-acid batteries.

4.1.2.2 Telecommunications equipment

The lines are equipped with the following types of communication:

- central dispatcher to local station operator (dispatching),
- station operators along the railway line with each other (dispatching),
- central dispatcher to locomotive drivers (radio communication with trains),
- station inspectors to locomotive drivers (radio communication with trains),
- locomotive drivers to each other (radio communication with trains),
- shunting personnel to locomotive driver and station operator (radio for shunting operations),
- party lines for permanent way maintenance staff,
- party lines for maintenance staff for communication facilities and signalling installations,
- communication between the signal boxes regarding remote control,
- local lines between two railway stations: these also include the telephones at the signals and turnouts at the entry and exit area.

- administrative and managing communication for all the staff (private switching telephone network - PSTN)
- teleprinter links with other railway networks
- data transmission links with the main railway stations and other railway networks.

4.1.2.2.1 Transmission backbone

Two types of transmission backbone are used:

- Copper buried cable,
- Open wire on pole.

These backbones support multiplex carrier systems using analogue FDM technology (Frequency Division Multiplexing).

There are of several types:

• P 306	60 channels cable	1990
• K 60 P	60 channels cable	1970
• K 12+12	12 channels cable	1960
• KB 12	12 channels cable	1960
• B 12-3	12 channelsopen wire	1960
• B 3-3	3 channelsopen wire	1960

Except for the P 306 system, these are not manufactured any more.
They are based on Soviet technology and are relatively old even though new line sections were installed during the last five years.

The multiplex systems for cable required repeaters every 20 km on average.
In 1994, in some rare locations, a new digital transmission system from Russia was installed: EKM 30 channels on copper quad at 2.048 Mbits/s. This system requires a repeater/regenerator every 4 km.

4.1.2.2.1.1 Copper cable

A multi-strand copper wire cable is used in a quad-type structure. Cables are jacketed and armoured for direct burial in a trench along the railway lines. These cables are buried at a depth of 0.8 to 1.2 meters, and are derived at each station. They are composed of:

- an external polyethylene sheath,
- an aluminium mechanical protection,
- 7 copper quads (4 wires) of 1.2 mm for telecommunications needs located at the centre of the cable,
- 5 copper pairs (2 wires) of 0.9 mm for signalling needs located around the telecommunications quads.

Along electrified sections of lines, an identical cable with additional metal screen (reducing factor screen) is used.

4.1.2.2.1.2 Open wire line

The open wire is fixed on a wood post with a 50 m span. It is composed of several wires as required (2 wires per line):

- bi-metallic lines for multiplex transmission (aluminium sheathed steel wires of 5.1 mm diameter),
- bi-metallic lines for audio frequency communication and signalling (zinc sheathed steel wires of 5 mm diameter).

The overhead lines are connected to the technical telecommunication rooms via buried cables.

The multiplex lines can support two different types of carrier systems:

- one 12-channel multiplex analogue system
  (2-wire type within a frequency range of 36 - 143 kHz), and
- one 3-channel multiplex analogue system
  (2-wire type within a frequency range of 4 - 31 kHz).

In the two systems, transmission direction separation is achieved by means of grouped-frequency operation. Since the two systems work in different frequency ranges, both can be switched by means of a corresponding frequency separating filter to a common two-wire circuit. In addition, a low-frequency link (LF-link) is switched to this two-wire circuit.
The transmission capacity of each multiplex line: 12 + 3 + 1 = 16 circuits.

4.1.2.2.2 Operating telephone systems

4.1.2.2.2.1 Dispatching system (party line)

This telephone system is a decentralised selective type system.
Each station has its own number and can be called selectively by the dispatcher or any other station. The dispatcher can also make general or a group of station calls.
This system is only used for train operation orders or information concerning train movements.

The main concentrator (all relay technology) is installed at dispatcher locations. It is a PSDT-4 type using 2-frequency code for calls.
This system operates on physical pairs up to 70/80 km. In the case of long distances, the line is divided into sections and the circuits are conducted directly via carrier frequency channels to each section.

4.1.2.2.2.2 Maintenance party line

This telephone system is identical to the dispatching system.
This system is only used for maintenance purposes.
The main concentrator is installed at district locations.

4.1.2.2.2.3 Permanent way telephones

These telephones use 2-wire circuits between stations along the line and are parallel-connected at level crossings, crossing points, maintenance offices, signal boxes, etc.
The telephones work with local battery and hand generators for ringing current.

4.1.2.2.2.4 Railway station telephone equipment

In all railway stations, station operator consoles of the DSP type have been installed for operations communications along the railway line. They are used in different sizes (number of lines that can be connected: 6, 8 or 19).

The following lines are connected:

- dispatcher line from the central dispatcher to all local station operators,
- party line for the local station operator without inclusion of the central dispatcher, but having access to all important offices in the railway network,
- party line for the permanent way maintenance staff,
- party line for the maintenance staff for communication facilities and signalling installations.

There is also the station-to-station line being a point-to-point connection to the left and the right neighbouring railway stations. In some railway stations specific local telephone sets are also included in the operational telephone system (signal boxes, maintenance offices, etc.).

4.1.2.2.3 Radio systems

There are two radio systems:

- train/dispatcher system dedicated to train operation,
- local station radio for shunting purpose.

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4.1.2.2.3.1 Train/dispatcher radio

It is a HF system (High Frequency) range of 2.1 MHz, using one single channel. It is a crystal frequency type from Russia, which was standard in the former Soviet Union and still is standard in today's CIS.

Only railway stations are equipped with fixed base radios. The aerial of the fixed base radio is fixed between poles in the vicinity of railway stations, they are about 20 to 30 m long.
All fixed base radios are linked to the dispatcher by means of the dispatcher party line circuit.

The central dispatcher can see where the individual trains are and send a call via the dispatcher circuit to the corresponding railway station. Also, the local station operator can intrude into the radio communication via his own telephone set.

All locomotives are equipped with an on-board radio.

4.1.2.2.3.2 Local station radio network

It is a VHF frequency range (140 to 174 kHz) simplex system, using two single channels different from the radio dispatcher system. It is a crystal frequency type from Russia.

Every large shunting station is equipped with two fixed radio bases, one at each station end with different channels. This radio system is used only in the direct vicinity of stations for shunting purposes.

Portable radio sets are installed in trolleys, snow-plough, breakdown and track maintenance trains.

The station staff in charge of shunting operations are equipped with hand-held radios from Bulgaria.

4.1.2.2.4 Private Switched Telephone network

For all administrative and management communications, there is an automatic switching telephone network organised in a star configuration and composed of the following:

- Step by step type (rotary) ATS-54, GATS-54A, UATS-49,
- Crossbar type (electromechanical) UPATS-400, ATSK-100/300, ATSK-100/2000,
- Electronic type ESK-400E, ESK-1000, QUANT,
- Digital type DRX-4.

Step by step and Crossbar types are not manufactured any longer.

Secondary PABX are linked by means of analogue trunk lines to the main transit PABX. Some of these PABX are also linked by trunk lines with the nearest ones. In a lot of places, long distance calls are only possible via manual operator.

In addition, main transit exchanges are also linked by trunk lines to the National Public Exchange (via the Public network). For communications with the public network, switching equipment of the type M-60 is used.

4.1.2.2.5 Telegraph and teleprinter network

At the headquarters all departments are equipped with teleprinters, as well as main stations. This network is mainly used to transmit management orders between departments and to distant stations.

The concentrator frames are of old telegraphic relay type. Transmission is ensured through audio-frequency channel with frequency division at 50 bauds.

Most teleprinters are of electromechanical type. Only a few of them are of computer type.

4.1.2.2.6 Management Information System (MIS)

These networks are equipped with concentrators and terminals in all the main railway stations. Dedicated lines are provided to the MIS for data communication needs.
These lines operate at 1200 Bits/s limited by transmission channels on the open wire lines. Due to the poor quality of transmission lines, the bit error rate is rather high.

For the main managing applications, such as rolling stock turn-over, all countries still depend on the Russian Railways centralised MIS in Moscow. The poor quality of the existing railway transmission circuits necessitates the leasing of lines from Public Network or Tele-communication companies.

4.1.2.2.7 Power supply for equipment

The technical installations within the telecommunication equipment rooms are powered with 24 or 60 V DC. At individual locations, the necessary rectifiers and batteries are available, operated by means of a buffer-battery system.
Most batteries are of open lead-acid type and need to be replaced.

4.1.2.3 Overhead catenary system (O.C.S.)

Part of the main lines are electrified with a 25 kV 50 Hz system, a section in Kazakstan used a 2 x 25 kV system. The length of lines equipped and the power available are adapted to the

present traffic and will cope with planned traffic. In the medium term, it is not necessary to plan any enlargement of the existing electrified sections.

4.1.2.3.1 Feeding system

The substations are powered from the 500 kV National Grid through a 220 kV transformer or through a railway 110 kV auto-transformer. In this case, railways operate and maintain a 110 kV feeder line between their substations.

4.1.2.3.2 Substations

The average distance between substations is 40 to 50 km, delivering 25 to 63 MW.
For the section equipped with 2 x 25 kV, the average distance between substations is 70 to 90 km, delivering 25 to 40 MW.

The HV 220 kV and 25 kV switches are of oil type.
The command/control is by electromechanical relays.

DC current ancillary systems are powered with open lead-acid batteries and backed by diesel generator.

4.1.2.3.3 Autotransformers

The average distance between autotransformers is 8 to 11 km, delivering 10 to 16 MW.

4.1.2.3.4 Catenary

The catenary is mounted on concrete poles.

The main characteristics of the catenary are given below:

<u>On permanent way</u>

- the contact wire is 100 mm^2 Copper
- the messenger is 95 mm^2 Copper-Steel (19 cores)
- the mechanical tensions applied are 1500 daN for contact wire and 1000 daN for messenger.
- maximum train speed: 120 km/h

<u>In station areas</u>

- the contact wire is 85 mm^2 Copper
- the messenger is 70 mm^2 Copper-Steel
-

4.1.2.3.5 Centralised command

The central remote control and command of the equipment is based on old relay technology. This equipment is similar to that used for the signalling system (NEVA type).

4.1.3 Kyrgyzstan

4.1.3.1 Railway network

The Kyrgyzstan railway network is composed of 423 km of single lines, not electrified.

The network is divided into two independent zones without any internal direct connection:

* the main corridor line to Kazakstan of 322 km,
* the four branch lines to Uzbekistan of 101 km.

4.1.3.1.1 The main corridor to Kazakstan

The main corridor line links Rybatchye to Lugovaya in Kazakstan. This line can be divided into two sections:

* the West section (150 km),
* the East section (172 km).

West section of the main corridor

There are 12 railway stations along this section including Bishkek I. The whole section is operated by a control centre (automatic block).
The first 60 km of this line are in Kazakstan but depend on Kyrgyzstan railways for operation and maintenance, including four stations controlled by the central dispatcher located at Bishkek.

East section of the main corridor

There are 10 railway stations along this section including Bishkek II. The whole section is monitored by the dispatcher located at Bishkek, train movements are controlled by each station (semi-automatic block).

4.1.3.1.2 Branch lines to Uzbekistan

There are four different branch lines linked to Uzbekistan lines:

* Osh branch line (3 railway stations),
* Kyzylkiya branch line (3 railway stations),,
* Dzhalal-Abad branch line (4 railway stations),
* Tashkumyr branch line (2 railway stations).

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The train movements are controlled by each station (semi-automatic block).

4.1.3.2 Consultant visit details

From 13th May to 17th May 1997 several meetings were organised in BISHKEK, with executives from:

- signalling department
- telecommunications department,
- computer department.

For telecommunications and signalling, all equipment rooms, operation centres, workshops and headquarters were visited in Bishkek area.

A line visit on board of the locomotive was made between Bishkek and Karabalta (approx. 60 Km).
During this visit, the principal technical executives met and interviewed were the following:

- Mr Golubev Alexander
  Chief Engineer for Communication and Signalling department
- Mr Pankratov Victor
  Deputy Chief for Communication and Signalling department
- Mrs Kaschko Ludmila
  Chief Engineer for Computer department.

4.1.3.3 General information

4.1.3.3.1 Operation main figures

Stabling and shunting yards

There are two major yards at Bishkek:

* a 12 track stabling yard where trains are parked following off-loading or awaiting dispatch,
* a 13 track shunting yard where all freight trains are sorted and prepared.

Train operation

For the section of line between Bishkek and Lugovaya, a single central signal box operates all train movements. It is located at Bishkek, and controls approximately 135 switching points and 150 different paths. These concern 12 railway stations, which in the case of a centralised command failure, can be individually operated in local mode.

The other lines are operated from local signal boxes located in each railway station, the safety of train movements is ensured by a semi-automatic block system.

In principle, all train movements on the line, at the stations and passing loops are co-ordinated and cleared by the central dispatcher's office in Bishkek.

4.1.3.3.2 Organisation and staffing

The railway's headquarters are located at Bishkek, including all technical departments and central workshops.

Telecommunications and signalling staff belong to the same department. This department is composed of 247 people (4.4 % of the total railway staff - 5,600 people).

The staff breakdown is the following:

* administration staff	13
* communication staff	120
* signalling staff	100 including Bishkek signal box operators
* radio staff	14

For signalling and telecommunications maintenance of the four branch lines, 24 people are permanently involved.
For the whole network the ratio of telecommunication and signalling staff is 0.58 persons per km of line.

4.1.3.3.3 Operation budget

The present operation budget for the signalling and communications department is about 10,500,000 KSS per year (600,000 USD).
It includes the following:

* Salaries	3,600,000 KSS	34.29%
* Charges (social fund)	1,200,000 KSS	11.43%
* Material purchase	1,200,000 KSS	11.43%
* Energy expenses	2,500,000 KSS	23.81%
* Structure and others	2,000,000 KSS	19.05%

The monthly average salary for technical staff is 1,215 KSS (69.4 USD). Charges paid by the railway to the state represent 33% of the salary.
This yearly budget represents 1,418 USD per km of line.

4.1.3.4 Signalling equipment

4.1.3.4.1 Equipment description

The whole network was equipped in 1977 with Russian equipment.

There are 60 level crossings with train-operated automatic warning light signals along the main line, they are of two types:

* 20 with barrier and a permanent guard,
* 40 without barrier.

Only the stations of the West section of the main corridor to Kazakstan are remote-commanded and controlled from Bishkek central signal box. The equipment is of all relay NEVA type from St. Petersburg.

4.1.3.4.2 Power supply equipment

Open line signalling equipment is supplied with power via an overhead line all along the railway line with a 3 x 10 kV three-phase current system and a number of low-voltage auxiliary transformers according to demand.

Signalling equipment is backed by means of lead-acid type batteries.

4.1.3.4.3 Present status of various equipment

The present signalling system on the line is appropriate for the current level of train service. Because of the configuration of the equipment, it would be possible to handle much more traffic than is currently the case.

All signalling installations are very properly maintained and thus in good condition and fit perfectly with the operational needs. The present status of equipment will suffice for another 15 years of operation, if sufficient spare parts are provided.

The consultant has been really impressed by the high quality of the maintenance work on the signalling equipment, as well as by the really professional repair work performed in the central workshop. The main problem for the maintenance staff is the lack of spare parts, small tools and instrumentation.

At present, there are no more local suppliers of this type of signalling equipment in Kyrgyzstan. All spare parts have to be directly imported from Russia.

4.1.3.4.4 Measures to be taken

Due to the high quality level of the maintenance performed, it would seem possible to keep the existing installation in operation for 15 more years, if sufficient budget is allocated for spare parts, instrumentation and tools purchase.

The reserve of spare parts is now close to zero, **the purchase of spare parts** (switching point motors, safety relay, batteries etc.) **is therefore an urgent short-term requirement.** Since it is difficult to know how long Russia will still supply this type of equipment, it is of the utmost importance to build up this stock urgently.

The maintenance staff has many difficulties in performing their tasks with the existing tools and instrumentation (many being badly damaged). The present budget for purchasing material, cables, instrumentation and tools is not sufficient for their needs, it must be increased to allow them to repair faulty equipment.

4.1.3.4.5 Estimation of investment needed

An emergency plan, **it is important to invest a minimum of 500,000 USD for vital spare parts purchases.**

4.1.3.5 Telecommunications equipment

4.1.3.5.1 Description

4.1.3.5.1.1 Transmission backbone

Two types of transmission backbone are used:

* Copper buried cable for the West section of the main corridor to Kazakstan 150 km or 35% of the network,
* Open wire on pole for the other sections of the network, 273 km or 65% of the network.

4.1.3.5.1.2 Dispatching system

All lines are equipped with dispatching party line telephones.

This system is only used for train operation control or information concerning train movements.

The main concentrator (all relay technology) is installed at Bishkek.

4.1.3.5.1.3 Radio systems

There are two radio systems:

- train/dispatcher system dedicated to train operation,
- local station radio for shunting purposes.

Train/dispatcher radio

Every station is equipped with a fixed base radio (Receiver/Transmitter). All fixed base radios are linked to the dispatcher at Bishkek by means of the dispatcher party line.
All locomotives are equipped with an on-board radio.

Local station radio
Every shunting station is equipped with two fixed Receiver/Transmitter bases, one at each station end with different channels. This radio system is used only in the direct vicinity of stations for shunting purposes.
The station staff in charge of shunting operations are equipped with hand-held radios from Bulgaria.

4.1.3.5.1.4 Private Switched Telephone network

For all administrative and management communications, there is an automatic switching telephone network organised in a star configuration and composed of the following:

- One central transit PABX (rotary type) of 1,200 lines located at Bishkek,
- One PABX of 800 lines (electronic type) located at Lugovaya,
- Six PABX (crossbar type) of 100 lines located at Karabalta, Sokuluk, Bishkek I, Alamedin, Tokmak and Rybatchye,
- Eight PABX (crossbar type) of 50 lines located at Merke, Kaindy, Belovodskaya, Shopokovo, Bystrovka, Kant as well as in wagon depots and locomotive depots.

All of these secondary PABX are linked by means of analogue trunk lines to the transit PABX at Bishkek. Some of these PABX are also linked by trunk lines with the nearest ones.
In addition, Bishkek transit exchange is also linked by 20 trunk lines to the National Public Exchange (via the Public network) and to the railway transit exchange located in Almaty (Kazakstan) by 2 trunk lines (via the railway network).

The automatic telephone network is composed of 16 PABX giving a whole capacity of 3,000 subscribers. Only 90% of the subscribers are wired - 2,700 subscribers connected.
The whole network provides a ratio of one telephone line for 2.1 people.

4.1.3.5.1.5 Data transmission network

At Bishkek headquarters, 78 computer terminals are installed in all departments. They are linked to a concentrator located in the computer centre via analogue modems.

The main problem is that there is no computer main-frame in Kyrgyzstan and all main application software are located at Almaty main frame.
This means that an important data exchange flow with Kazakstan is required daily. The only available path is a 1,200 bits/s circuit through the railway transmission system.

During the last two years, the computer department has tried to develop a data transmission network with all the distant sites of the network, in order to computerise some tasks, such as rolling stock management, freight follow-up, etc.
This network is composed of the following:

- the main concentrator at Bishkek,
- two secondary concentrators at Dzhalal-Abad and Karasu,
- twelve terminals in the railway stations along the main corridor line,
- thirteen terminals in the main railway stations of the four branch lines with Uzbekistan.

The transmission lines linking the terminals and concentrators are of 1,200 bits/s except for the link between Bishkek and Dzhalal-Abad concentrators (500 km) where a leased line of the National Public network is used offering a 9,600 bits/s data flow. The yearly leasing cost for this circuit is 3,200 USD.
The transmission lines between Tashkumyr and Dzhalal-Abad, Kyzylkiya and Karasu, Kashgar-Kishlak and Karasu, are also leased from the National Public network.

4.1.3.5.2 Present status of various equipment

4.1.3.5.2.1 Transmission backbone

The existing transmission backbone cannot cope any longer with the railway's communication needs. The copper cable and the open wire line do not permit the installation of any additional transmission equipment (full capacity) or to replace the existing multiplex equipment by new ones (not adaptable).

All the multiplex are of obsolete technology and no longer manufactured. Thus, it is not possible to find any spare parts.

The only short term solution in order to maintain operability of the equipment is by the method of cannibalisation — "make one out of two": Components (transistors, diodes, capacitors, etc.) are soldered out of less vital installations and are inserted into those systems which are urgently needed.

It is clear, that sometime during the years to come, the transmission systems will no longer be operable in conditions acceptable for normal operation of the railways. There is no other solution than to plan the replacement of the whole transmission equipment and the implementation of a new transmission backbone.

Siemens has submitted to the railways a technical proposal for the replacement of the existing transmission backbone and transmission equipment for the whole main corridor. This financial proposal was of 4.85 Million DEM or approx. 2.9 Million USD.
This proposal consists of a 6-fibre optical cable supporting a STM-1 SDH digital transmission equipment (155 Mbits/s) and all multiplexers for the stations.
This is technically very good but the proposal does not include:

- * copper cable for East part of the corridor,
- * new dispatcher system,
- * new fixed radio bases, on-board and handheld radios,
- * Bishkek PABX,
- * new batteries.

4.1.3.5.2.2 Dispatching system

These equipments are still working but are not highly reliable and the quality of service will decrease quickly over the coming years. Spare parts are available. Replacement must be foreseen during the next 10 years.

4.1.3.5.2.3 Radio systems

Both systems are really at the end of their lifetime and need to be changed. The quality of speech is really poor and makes train operation more difficult.
Replacement must be foreseen during the next 10 years.

4.1.3.5.2.4 Private Switched Telephone network

The central PABX located at Bishkek is of obsolete technology. It needs a high level of day to day maintenance and makes the procurement of spare parts impossible. No supplier is still manufacturing this type of PABX.

In addition, due to the small capacity of the transmission backbone, the number of trunk lines is very low and does not correspond with the needs.

The maintenance staff is encountering more and more difficulties to keep the PABX network in good operating condition. Therefore, it is foreseeable that at a specific point in the near future the central PABX will no longer be operable.

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4.1.3.5.2.5 Data transmission network

In order to develop real computerised services for Kyrgyzstan Railways, it is important that they can have their own main computer frame in Almaty.

4.1.3.5.3 Measures to be taken

It is very difficult for the maintenance staff to perform their tasks with the existing tools and instrumentation (a lot of these are badly damaged). The present budget for purchasing small material, instrumentation and tools is not sufficient for their needs, and must be increased to allow them to repair faulty equipment.

The existing communication systems and installations are not in good condition and have a bad effect on train movements. The situation will become worse year after year, due to the following problems:

- in most cases, equipment has reached it's limit of life,
- procurement of spare parts is not possible,
- obsolete technology is used which needs a high level of maintenance
- no possibility to enlarge the system, not even by system components of western companies, since the systems have not been manufactured for several years.

Thus, the only solution that can be offered is to completely renew virtually all communication systems of the main corridor, which is **urgently recommended**.

Urgent investments are necessary for the main corridor line to Kazakstan, where all equipment must be replaced. All the existing equipment and open wire materials can be used as spare parts to maintain the four branch lines to Uzbekistan, that will be sufficient for 10 years minimum.

Transmission backbone

- For the West part of the corridor a 10-fibre self-supported optical cable can be mounted on the existing power supply poles, the existing copper cable could be used for signalling purposes between stations and block sections.
- For the East part of the corridor, two self-supported cables can be mounted on existing poles. One 10-fibre optical cable for communication and one 10-pair copper cable for signalling circuits between stations and block sections.

The existing overhead line poles are generally adequate. Only the anchoring poles would need additional guy wires on both sides in the direction to the overhead line route.

The optical cable could be composed of 10 fibres:

- 4 fibres for double loop configuration SDH network,
- 2 spare fibres for railways needs,

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- 4 fibres to be leased to National Public Telephone network.

The revenues from fibres leased will cover the maintenance costs of cable and transmission equipment.

Communication equipment

- Transmission technology: replacement of the analogue carrier-frequency systems by digital SDH system (STM-1: 155 Mbits/s).
- Dispatcher selective telephone: replacement of the existing equipment by modern, digital systems.
- Radio installations: replacement of the existing fixed radio bases and hand-held radios.
- Telephone network: replacement of Bishkek PABX by a digital telephone exchange.
- Replacement of all batteries.
- Measuring devices: the existing measuring devices need to be renewed in part and completed by the necessary maintenance of digital systems.

4.1.3.5.4 Estimation of investment needed

To perform the daily maintenance tasks, **it is urgent to invest 250,0000 USD for new instrumentation and various tools in the short term.**

The main corridor needs to be equipped with a new transmission backbone over the next few years, in order to maintain an acceptable level of train operation.

In addition, part of the remaining communication equipment needs to be replaced, because it cannot be used any longer.

The total estimated amount needed for telecommunication rehabilitation is approx. 5,760,000 USD.

Details of the needs for these sections are given below:

Replacement of transmission backbone

Details of the needs:

- Installation of 322 km of optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and 172 km of copper cable for permanent way distribution

Estimated cost for rehabilitation:	**4,600,000 USD**
• Supply:	3,000,000 USD
• Installation:	1,000,000 USD
• Spare parts & tools:	450,000 USD
• Training & measurement:	150,000 USD

Replacement of operating telephones (dispatcher)

Details of the needs:

- Replacement of 22 station operator consoles and 2 main dispatching system concentrators

Estimated cost for rehabilitation:	**300,000 USD**
• Supply:	200,000 USD
• Installation:	60,000 USD
• Spare parts & tools:	30,000 USD
• Training & measurement:	10,000 USD

Replacement of radio equipment

Details of the needs:

- Replacement of 20 fixed base radios and 20 on-board equipment for train/dispatcher radio system (including cables and antenna).
- Replacement of 10 fixed base radios (including cables and antenna) and 40 hand-held radios (with spare batteries) for shunting radio system.

Estimated cost for rehabilitation:	**500,000 USD**
• Supply:	330,000 USD
• Installation:	100,000 USD
• Spare parts & tools:	50,000 USD
• Training & measurement:	20,000 USD

Bishkek PABX replacement (administrative telephones)

Details of the needs:

- One PABX of 1000 to 2000 lines

  (including all telephone sets, distribution cables and connectors)

Estimated cost for replacement:	**360,000 USD**
• Supply:	240,000 USD
• Installation:	80,000 USD
• Spare parts & tools:	30,000 USD
• Training & measurement:	10,000 USD

4.1.3.6 Line electrification

There is no electrified line on this railway network.

During the time prior to the break-up of the USSR, there was a projected investment for electrifying the line between Almaty and Bishkek, but due to the political changes and the lack of funds nothing has been done.

4.1.3.7 Conclusion

The site visits by the Consultant show that:

Signalling equipment:
The signalling system is generally in good condition and functions satisfactorily. However, the lack of vital suitable spare parts is a cause for concerns and dictates as **an emergency action to invest approx. 500,000 USD for vital spare parts.**

Telecommunications equipment:
For performing the daily maintenance tasks, **it is urgent to invest 250,0000 USD for new instrumentation and various tools in the short term.**

The communication network is generally working, but with an increasing number of faults which can be expected to accelerate over the next few years. This is due mainly to equipment obsolescence; it will need to be replaced by a modernised system in the short term. At the present time it is impossible to find the necessary spare parts (not any more manufactured for most of the equipment); and this will have an increasing influence, thus rendering the systems increasingly unreliable and making maintenance more and more expensive.

It is urgently required to invest in such measures as **telecommunication backbone and communication equipment replacement** for the main corridor in response to existing difficulties, and in anticipation of future problems. **This represents an investment of 5,8 Million USD approximately.**

4.1.4 Kazakstan

4.1.4.1 Railway network

The Kazakstan railway network is composed of 13,410 km of lines:

- 33 km of triple track line,
- 8,310 km of double lines,
- 5,167 km of single lines.

There are 3,050 km (23%) of lines electrified in 25 kV AC.

About 10,700 km (80%) of lines are equipped with an automatic or semi-automatic block system.
About 8,900 km (66%) of these lines are under centralised traffic command.

The network is composed of 530 stations:

- 350 small stations (under 15 switches)
- 130 medium stations (15 to 60 switches)
- 50 large stations (over 60 switches)

Along the main lines the average distance between stations is about 15 km, along the secondary lines about 30 km.

Main lines

Following our discussions with local counterparts, it appears that in fact three main corridors handle most of the traffic or are of important interest for the country.

These corridors are:

- Western corridor: 2,093 km
  from Tashkent (Uzbekistan) to Ozinki (Russian border) via Tchengeldy (Uzbekistan border), Arys, Kzyl-Orda, Kandagatch, Aktyubinsk, Iletsk and Uralsk.
- Northern corridor: 2,115 km
  from Druzhba (Chinese border) to Kurgan (Russia) via Aktogay, Mointy, Akmola, Kokshatav, Novoishimskaya and Presnogorkovskaya (Russian border).
- Trans-Asian corridor: 1,390 km (+ 387 km common with other corridors)
  from Tashkent (Uzbekistan) to Druzhba (Chinese border) via Tchengeldy (Uzbekistan border), Arys, Tchu, Almaty and Aktogay.

In addition, the section of line which links Northern and Trans-Asian corridors between Tchu and Mointy (434 km) can also be considered and can be used as a by-pass or an alternative route.

The total length of these corridors plus the by-pass is 6,032 km of line which represents 45% of the whole network.

4.1.4.2 Consultant visit details

From 18th May to 24th May 1997 several meetings were organised in ALMATY, with all the Railway project and development institute (Kazgiprozheldortrans) staff responsible for:

- signalling,
- telecommunications,
- electrification.

For telecommunications and signalling, all equipment rooms, operation centres and work-shops were visited in ALMATY I station area.

During this visit, the principal executives met and interviewed were the following:

- Mr Novitski Evgeny (Kazgiprozheldortrans Institute)
  Project co-ordinator for TACIS project
- Mr Yagmurov Sergey (Kazgiprozheldortrans Institute)
  Chief for Signalling studies
- Mrs Izverova Valentina (Kazgiprozheldortrans Institute)
  Chief for Telecommunications studies
- Mr Bulin Anatoli
  Chief of Central Traffic Control at Almaty I.

Discussions with executives at the Railway Headquarters could not take place because the information required had been already given to another team of experts. Nonetheless, the consultant has managed to secure this information which has been used for this report.

4.1.4.3 General information

4.1.4.3.1 Operations main figures

Train operations

Approximately 80% of the whole Kazakstan network is equipped with light colour signals, block system, track circuits and electric switching points (except for small shunting tracks where they are hand-operated).

All railway stations and passing loops have at least two passing tracks.

For about 66% of the network, all journeys on the lines and at the railway stations are supervised by a Centralised Traffic Control office (CTC). There are 14 of these CTC throughout the network.

Operations within 'station limits' (also within marshalling yards) are exempted from this rule. Shunting traffic at these railway stations is co-ordinated between the station's operator and the dispatcher of the supervisory railway station who also sets up the route and permits the (shunting movements and) journeys.

The largest stations such as Tchu, Almaty I and Akmola, etc., are controlled only locally. This is due to the extremely high daily movements required in these stations.

4.1.4.3.2 Organisation and staffing

The general railway's headquarters are located at Almaty (former headquarters when the network was divided in three). There are three main locations, at Almaty, Akmola and Aktyubinsk, where the central workshops and technical departments are located.

The network is divided in 41 regional centres which are in charge of a part of the network.

Telecommunications and signalling staff belong to the same department. The average staff of these regional centres is about 250 people. This means about 10,250 people are working for the signalling and telecommunications department (5.4 % of total railways staff -191,000 people).

For the whole network the ratio is 0.76 persons per km of line.

The staff is composed of:

* 15% engineers,
* 50% technicians,
* 35% workers.

The training facilities for the railway staff are:

- The « Academy of Railway Transportation » at Almaty,
- 6 technical schools scattered over the country.

4.1.4.3.3 Maintenance budget

The present operating budget for the signalling and communications department could not be found, the only figures available were the global budget for telecommunications and signalling during the years 1987 to 1990.

During this period, the average yearly budget was 38 Million USD, which included some investments made for new installations.

The present monthly average salary for technical staff is:
9,800 Tenge (131 USD).

Charges and taxes paid by the Railways to the state represent:
50% of the salaries.

It is only possible to make an estimation of what the yearly budget should be under normal conditions:
3,700 Million KZT, approximately 50 Million USD.

This estimated budget includes the following:

* Salaries	1,200 Million KZT	32.43%
* Charges and taxes	600 Million KZT	16.22%
* Material and spare parts purchases	400 Million KZT	10.81%
* Energy expenses	850 Million KZT	22.97%
* Structure and others	650 Million KZT	17.57%

This yearly budget represents 3,704 USD per km of line.

4.1.4.4 Signalling equipment

4.1.4.4.1 Equipment description

Station equipment

The network is equipped with two types of Russian equipment:

- before 1978 type; about 30% of the network,
- after 1978 type; about 70% of the network.

Central Traffic Control

These installations are of two types:

- NEVA technology (as Almaty I) which is the oldest based on industrial relays to send and receive command/control information. The system include some electronic circuits.
- MINSK type (as Akmola) which is more recent and uses only electronic cards.

4.1.4.4.2 Present status of various equipment

The present signalling system on the line is appropriate for the current level of train service. Because of the configuration of the equipment, it would be possible to handle much more traffic than is currently the case today.

Station equipment and block system

All equipment for interlocking and safety are based on relay technology of the 50's. This technology is obsolete but uses robust equipment which is easy to maintain.

All equipment installed after 1978 can last for many years.

The equipment installed before 1978 represent 30% of the total equipment in use, it has in most cases been installed 30 or 35 years ago. There is a real problem to maintain this equipment in good operation, as it has now reached the limit of its lifetime and will be subject in the next few years to an increasing number of faults.

There are however, only a small number of signalling failures and of low consequence with regard to traffic. During the year 1996, only 1,570 failures were registered for the whole network.

In each regional centre, there is a signalling workshop which cyclically tests and verifies all the relays. The cycles are of 1, 3, 5, 10 or 15 years depending on type and use. This means approximately 200,000 relays or 10% of all existing relays (2,000,000) are cleaned, adjusted and tested every year.

Tacis
This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

At Almaty, there is a national workshop for heavy switching point machine repairing, such as replacement of coils in the electric motor. This equipment may be bought in the Ukraine.

Provisions must be included in the operating budget to buy spare parts which are still manufactured (relays, motor points, batteries). After our discussions, it seems that during the last five years there has been a lack of funds for this purpose.

Central Traffic Control

The NEVA type components are not manufactured any more and the only way to maintain these installations is to use equipment parts which have been removed from another place.

For the MINSK type, the electronic cards are no more manufactured and during the next 10 years, problems will arise when all spare parts presently available are used up.

Power supply equipment

A great part of the installations are backed with batteries, which are for a large percentage of the cases in very poor condition. Their total replacement should be planned within the next five years.

4.1.4.4.3 Measures to be taken

Due to the present level of the maintenance performed, it is possible to keep in operation about 70% of the existing installations for 15 years longer, if investment is sufficient to buy spare parts, instrumentation and tools.

The present reserve of spare parts will not be sufficient for long, **it is urgent to buy in the short term a stock of spare parts** (switching point motors, safety relay, batteries, etc.). It is difficult to know for how long Russia will still supply this type of equipment, which is why it is so important to take this measure urgently.

For the 30% of installations over 30 years old, there is no other solution than to plan their replacement in the short-term, especially on the main corridors. All these installations should be used as spare parts for the secondary lines.

4.1.4.4.4 Estimation of investment needed

As an emergency plan during the next five years for day to day signalling maintenance, **it is important to invest a minimum of 1,000,000 USD to buy vital spare parts, tools and instrumentation.**

Some sections of main lines need to be rehabilitated in the next few years, in order to maintain an acceptable level of train operations. **The estimated costs for rehabilitation of these sections is 38,000,000 USD.**

Details of needs for these sections are given below:

Western corridor
Aktyubinsk to Ozinki (682 km)

Details of the needs:

- New station signalling equipment: 35 small stations and 2 large stations
- New automatic block system
- Central Traffic Control for the section

Estimated cost for rehabilitation:	**18,500,000 USD**
• Station equipment:	6,500,000 USD
• Block equipment:	4,800,000 USD
• Central command:	1,200,000 USD
• Installation:	4,000,000 USD
• Spare parts & tools:	1,500,000 USD
• Training & measurement:	500,000 USD

Northern TRACECA corridor
Druzhba to Aktogay (310 km).

This section of line will be rehabilitated in the scope of a project financed by Japanese funds (100 Million USD). But this project does not include signalling equipment.

Details of the needs:

- New station signalling equipment: 12 small stations and 1 large station (Druzhba not included: 110 switches which have been renewed in 1995)

Estimated cost for rehabilitation:	**3,400,000 USD**
• Station equipment:	2,300,000 USD
• Installation:	700,000 USD
• Spare parts & tools:	300,000 USD
• Training & measurement:	100,000 USD

Aktogay to Ush-Tobe (240 km)

Details of the needs:

- New station signalling equipment: 13 small stations and 2 large stations
- New automatic block system
- Central Traffic Control for the section

Estimated cost for rehabilitation:	**7,500,000 USD**
• Station equipment:	2,900,000 USD
• Block equipment:	1,700,000 USD
• Central command:	400,000 USD
• Installation:	1,500,000 USD

- Spare parts & tools: 700,000 USD
- Training & measurement: 300,000 USD

Ush-Tobe to Almaty (220 km)

Details of the needs:

- Central Traffic Control for the section

Estimated costs for rehabilitation: **600,000 USD**

- Central command: 400,000 USD
- Installation: 130,000 USD
- Spare parts & tools: 50,000 USD
- Training & measurement: 20,000 USD

Trans-Asian corridor
Sajak to Mointy (350 km)

Details of the needs:

- New station signalling equipment: 9 small stations and 2 large stations
- New automatic block system
- Central Traffic Control for the section

Estimated cost for rehabilitation: **8,000,000 USD**

- Station equipment: 2,200,000 USD
- Block equipment: 2,500,000 USD
- Central command: 600,000 USD
- Installation: 1,600,000 USD
- Spare parts & tools: 800,000 USD
- Training & measurement: 300,000 USD

4.1.4.5 Telecommunication equipment

4.1.4.5.1 Equipment description

Transmission backbone

The open wire transmission lines are very old, the first system was installed in 1905. The open wire lines make up over 50% of the total transmission links, approximately 6,900 km. The other sections of lines (6,700 km) are equipped with buried cables supporting multiplex systems and audio-frequency circuits.

For the main transmission routes several K 60-P systems are used (X times 60 channels), most of them were installed around 1972.

The cable transmission capacity varies on different routes with a maximum capacity of 360 channels on the section between Almaty and Akmola.

The two main transmission centres are Tchu and Akmola with the largest number of circuits, approximately 660, as there are major junctions.

There are no microwave systems although a contract has been let to Siemens for a light route microwave (130 km) from Aktyubinsk to Uralsk (Russian border). A global cost of 5,000,000 USD has been given to us but without any technical information. The cost mentioned seems to the consultant to be very expensive for the type of equipment envisaged.

A project financed by the Japanese is already in progress between Druzhba and Aktogay (320 km). It consists of the installation of 2 copper buried cables along the line with multiplex systems, and the replacement of all telephone equipment in the railway stations, for a total cost of 5,000,000 USD.

The consultant was quite surprised that both cables are of the copper type and that no optical cable has been chosen for long distance transmission. The cost should be roughly similar with one long distance optical transmission cable and one copper cable for permanent way equipment distribution.

PABX (administrative telephones)

The automatic telephone network is composed of 76 PABX giving a whole capacity of 75,000 subscribers. Only 90% of the subscribers are wired -68,000 subscribers connected.

The whole network offers a ratio of one telephone line for 2.8 people.

The four different technologies of PABX are distributed as below:

- 36% of Step-by-Step (1970)
- 27% of Electromechanical (1980),
- 32% of Electronics (1990),
- 5% of Digital (1994-95).

The majority of inter-railway long distance communications is handled through operators and manual patch-boards.

4.1.4.5.2 Present status of various equipment

Transmission backbone

The open wire line systems have been discontinued world-wide. In general these systems are noisy, subject to external disturbances, limited in channel capacity and do not allow high speed rate data transmission.

All the multiplex for open wire line are of obsolete technology and no longer manufactured. Thus, it is not possible to find any spare parts.

Some of the cables are already over 25 years old and numerous transmission problems occur at the splicing points. There are problems of corrosion due to water ingress which may be accelerated in the forthcoming years. Splices are always a weak point for transmission, there is an average of one to two splices per kilometre of cable.

Dispatching party line (operating telephones)

Part of this equipment is of the 1960 generation and needs to be replaced by new, it can be said that 20% of the stations (approx. 100) need new telephone consoles and 4 dispatcher main concentrators should be replaced.

Radio equipment

Some fixed radio bases for train/dispatcher radio need to be replaced, as well as fixed radio and hand-held radios for shunting purposes in large stations.

PABX (administrative telephones)

The automatic telephone network presents three major problems:

- the poor quality of the lines in some parts of the network,
- the lack of trunk lines between PABX,
- the difficulty to maintain the oldest PABX.

The first two problems affect the transmission backbone; the open lines are adapted to high quality of speech and the capacity of some transmission sections does not allow to have sufficient trunk lines.

This could be improved by the replacement of open wire lines and multiplex equipment.
The third problem could be solved only by the replacement of all the old Step-by-Step PABX. They have not been manufactured for many years and it is impossible to find spare parts.

4.1.4.5.3 Measures to be taken

It is very difficult for the maintenance staff to perform their tasks with the existing tools and instrumentation (a lot of these are deadly damaged). The present budget for purchasing small material, instrumentation and tools, is not sufficient for their needs, and it must be increased to allow them to repair faulty equipment.

For the older installations; over 30 years old, there is no other solution than to plan their replacement in the short-term especially on the main corridors. All these removed installations should be used later as spare parts for the secondary lines.

Transmission backbone

It is a priority to remove all open wire lines, especially along all the main line sections.
The main sections of lines to be renovated are the following:

- Aktyubinsk to Uralsk (550 km)

- Kzyl-Orda to Arys (393 km)
- Mointy to Sajak (336 km)

These line sections should be equipped with optical cable and digital transmission equipment for long distance needs and with a copper cable for permanent way distribution (signalling circuits between stations and block sections). The two cables should be self supported cables and could be mounted on existing poles.

The optical cable could be composed of 10 fibres:

- 4 fibres for double loop configuration SDH network,
- 2 spare fibres for railways needs,
- 4 fibres to be leased to the National Public Telephone network.

The revenues from fibres leased will cover the maintenance costs of the cable and transmission equipment.

Along these lines the existing analogue carrier-frequency systems will be replaced by digital SDH system (STM-1: 155 Mbits/s).

To solve insulation problems on existing cables, it is essential to buy 100 km of copper cable (replacement of heavily damaged sections) and 200 junction boxes for splices. There is a new type of junction box which will greatly improve water ingress prevention.

Dispatching party line (operating telephones)

About 100 stations need new telephone consoles and 4 dispatcher central concentrators are required with digital technology.

Radio equipment

In a first step, it is recommended to replace 50 fixed radio bases and 20 on-board equipment for train/dispatcher radio, 30 fixed radios and 50 hand-held radios for shunting purposes in large stations. Removed radios will be used as components and accessories reserve for radio repair shops.

PABX (administrative telephones)

More than a third of the existing PABX are too old and need to be replaced. There are 25 PABX to be replaced corresponding to approximately 30,000 subscribers. Digital exchanges must be installed instead of the existing ones.

4.1.4.5.4 Estimation of investment needed

To perform the daily maintenance tasks, **it is urgent in the short term to invest 750,0000 USD for new instrumentation and various tools.**

Some sections of main lines need to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operation.

In addition, part of other communications equipment needs to be replaced, because they cannot be used any longer.

The total estimated costs needed for telecommunication rehabilitation is about 36,000,000 USD.

Details of needs for these sections are given below:

Replacement of transmission backbone from Aktyubinsk from Uralsk

Details of the needs:

- Replacement of 550 km of open wire lines by optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and copper cable for permanent way distribution

Estimated cost for rehabilitation: **9,200,000 USD**

- Supply: 6,100,000 USD
- Installation: 1,900,000 USD
- Spare parts & tools: 900,000 USD
- Training & measurement: 300,000 USD

Replacement of transmission backbone from Kzyl-Orda to Arys

Details of the needs:

- Replacement of 393 km of open wire lines by optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and copper cable for permanent way distribution

Estimated cost for rehabilitation: **6,600,000 USD**

- Supply: 4,400,000 USD
- Installation: 1,300,000 USD
- Spare parts & tools: 700,000 USD
- Training & measurement: 200,000 USD

Replacement of transmission backbone from Mointy to Sajak

Details of the needs:

- Replacement of 336 km of open wire lines by optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and copper cable for permanent way distribution

Estimated costs for rehabilitation: **5,800,000 USD**

- Supply: 3,800,000 USD

- Installation: 1,200,000 USD
- Spare parts & tools: 600,000 USD
- Training & measurement: 200,000 USD

Improvement of existing cable performance

Details of the needs:

- Replacement of 100 km of copper cable and 200 junction boxes.

Estimated cost for rehabilitation: **1,000,000 USD**

- Supply: 650,000 USD
- Installation: 200,000 USD
- Spare parts & tools: 100,000 USD
- Training & measurement: 50,000 USD

Replacement of operating telephones (dispatcher)

Detail of the needs:

- Replacement of 100 station operator consoles and 4 main dispatching system concentrators

Estimated costs for rehabilitation: **980,000 USD**

- Supply: 650,000 USD
- Installation: 200,000 USD
- Spare parts & tools: 100,000 USD
- Training & measurement: 30,000 USD

Replacement of radio equipment

Details of the needs:

- Replacement of 50 fixed base radios and 20 on-board equipment for train/dispatcher radio system (including cables and antenna).
- Replacement of 30 fixed base radios (including cables and antenna) and 50 hand-held radios (with spare batteries) for shunting radio system.

Estimated costs for rehabilitation: **900,000 USD**

- Supply: 600,000 USD
- Installation: 180,000 USD
- Spare parts & tools: 90,000 USD
- Training & measurement: 30,000 USD

PABX replacement (administrative telephones)

Details of the needs:

- 4 PABX of 500 lines
- 8 PABX of 500 to 1000 lines

- 13 PABX of 1000 to 2000 lines
- (including all telephone sets, distribution cables and connectors)

Estimated costs for replacement:	**10,800,000 USD**
• Supply:	7,200,000 USD
• Installation:	2,200,000 USD
• Spare parts & tools:	800,000 USD
• Training & measurement:	600,000 USD

4.1.4.6 Overhead catenary system (O.C.S.)

4.1.4.6.1 Equipment description

About 3,700 km of lines are electrified (27,6% of the network), which amounts to approximately 10,000 km of catenary wire.

The electrified network is powered by 62 substations.

4.1.4.6.2 Present status of various equipment

A technical survey in Kazakstan has been done by a Systra expert which shows that, mainly, the electrified installations are in good condition, but suffer from a lack of vital spare parts. That will be critical in a few years if nothing is done.
Several pieces of equipment are deficient and need to be replaced in the short term, to avoid any main outage. Mainly, this concerns transformers, switches and protections. Also, as a normal maintenance cycle, it is necessary to replace contact and messenger wires at those places where most wearing occurs (mostly switching areas in station and yards).

The technology used today is obsolete as far as switches, command/control, remote and protection equipment are concerned.

For local control frames in substations and switching points, and for remote control system, it is important to plan the total replacement of this equipment in the medium term (10 years). They are obsolete and their maintenance will get more and more difficult in the years to come.

4.1.4.6.3 Measures to be taken

Following Systra's expert survey, a list of the replacement needs has been drawn up for the next 15 years. In this report the consultant focuses on vital requirements for the next five years.

The main equipment to be replaced in the short term will represent 50% of the needs and are the following:

- In substations:
  - 7 main transformers need to be repaired,
  - 150 surge arrestors (already 140 of these are damaged),
  - 80 HF oil type switches need to be replaced by gas type,
  - 250 25 kV switches need to be replaced (already 100 have been changed),
  - 250 distance and impedance catenary protections must be replaced.
- Catenary:
  - 200 km of catenary wire and 100 km of messenger wire need to be replaced,
  - Replacement of glass insulators, section insulators, anchoring devices and droppers must be planned.

4.1.4.6.4 Estimation of investment needed

Some vital parts have to be replaced in the next few years, in order to maintain an acceptable level of train operations.

Part of the mechanical equipment (wires and accessories) needs to be replaced as well, because it has reached the limits of its wear.

The total estimated cost for this rehabilitation is approx.: 23,500,000 USD.
Details of the needs for these sections are given below:

Replacement of faulty equipment in substations

Details of the needs:

- Refurbishing of main damaged transformers.
- Replacement of surge arrestors, HF oil type switches, 25 kV switches and impedance catenary protections.

Estimated cost for rehabilitation: **21,000,000 USD**

- Supply: 14,000,000 USD
- Installation: 4,200,000 USD
- Spare parts & tools: 2,100,000 USD
- Other expenses: 700,000 USD

Maintenance of catenary

Details of the needs:

- Replacement of contact wire and messenger,
- Replacement of glass insulators, section insulators, anchoring devices and droppers.

Estimated cost for rehabilitation: **2,500,000 USD**

- Supply: 1,600,000 USD
- Installation: 500,000 USD
- Spare parts & tools: 300,000 USD

- Other expenses: 100,000 USD

4.1.4.7 Conclusion

The site visits by the Consultant show that:

Signalling equipment:

The signalling system is generally in good condition and functions satisfactorily. It is possible, due to the present level of the maintenance performed, to keep in operation about 70% of the existing installations for 15 years longer, provided that investment is sufficient to buy spare parts, instrumentation and tools.

The present reserve of spare parts will not be sufficient for long, **it is urgent to invest 1,000,000 USD in the short term for a stock of spare parts** (switching point motors, safety relays, batteries, etc.).

Some sections of main lines need to be rehabilitated in the next few years, in order to maintain an acceptable level of train operations. **The estimated cost for rehabilitation of these sections is 38,000,000 USD.**

Telecommunications equipment:

To perform the daily maintenance tasks, **it is urgent to invest 750,0000 USD for new instrumentation and various tools in the short term.**

The communication network generally works, but with an increasing number of faults which can be expected to accelerate over the next few years. That is due mainly to the equipment obsolescence; it will need to be replaced by a modernised system in the short term.

For the older installations; over 30 years old, there is no other solution than to plan their replacement in the short term, especially on the main corridors. All these removed installations should be used later as spare parts for the secondary lines. It is a priority to remove all open wire lines, especially along main corridors. The sections of lines to be renovated are the following:

- Aktyubinsk to Uralsk (550 km)
- Kzyl-Orda to Arys (393 km)
- Mointy to Sajak (336 km)

The total estimated cost for telecommunication rehabilitation is approximately 36,000,000 USD.

O.C.S.:

Some vital parts of the O.C.S. need to be replaced in the next few years, in order to maintain an acceptable level of train operations. Part of the mechanical equipment (wires and accessories) need to be replaced as well, because they have reached the limits of wear.

The total estimated cost for O.C.S. rehabilitation is approximately 23,500,000 USD.

4.1.5 Uzbekistan

4.1.5.1 Railway network

The Uzbekistan railway network is composed of 3,655 km of lines:

- 682 km of double lines,
- 2,973 km of single lines.

There are 353 km (9.7%) of 25 kV AC electrified lines:

- Tashkent - Tchengeldy (Kazak border),
- Tashkent - Khavast - Bekabad (Tadjik border, on the line to Fergana valley),
- Khavast - Dzhizak

Electrification is going on (very slowly) on the sections Syrdarya - Dzhizak and Dzhizak - Dzhambaj (Samarkand junction). Catenary is already installed, the substations are not finished. Uzbek Railways are looking for support from International Financing Institutes (EBRD, Asian banks) to finalise the works and to obtain the necessary rolling stock for electric traction.

An additional 65 km section of line between Tashkent and Tchirtchik is partially equipped with catenary poles, the electrification of this section had been stopped some years ago due to lack of funds.

Main lines

The TRACECA corridor between Kazakstan and Turkmenistan is approximately 750 km long, which represents 20% of the whole network.

In addition, the lines which serve Fergana valley and South of Kyrgyzstan via Khavast can also be considered main lines.

4.1.5.2 Consultant visit details

From 26th May to 31st May 1997 several meetings were organised in Tashkent, with the Railway's executives for:

- signalling,
- telecommunications.

For telecommunications and signalling, all equipment rooms, operation centres and workshops were visited in the Tashkent area.

During this visit, the principal executives met and interviewed were the following:

- Mr Erkinov Navruz
  International department
- Mr Gubatchev Vladimir
  International department
- Mr Kaluzhny Alexej
  Chief of Telecommunication & Signalling department
- Mr Kudyakov Muhammed Ali
  Chief of Signalling & Telecommunication Tashkent district

4.1.5.3 General information

4.1.5.3.1 Operation main figures

Train operations

The whole Uzbekistan network is equipped with light colour signals, block system, track circuits and electric switching points (except for small shunting tracks where they are hand-operated).

All railway stations and passing loops have at least two passing tracks.

All train movements on the lines and at the railway stations are supervised by a Centralised Traffic Control office (CTC) located at Tashkent. The network is divided into 13 sections supervised by 9 dispatchers.

Operations within 'station limits' (also within marshalling yards) are exempted from this rule. Shunting traffic at these railway stations is co-ordinated between the station's operator and the dispatcher.

The largest stations are controlled only locally. This is due to the very high daily movements required in these stations.

4.1.5.3.2 Organisation and staffing

The General Railway's Headquarters are located at Tashkent.

The network is divided into 10 divisions which are in charge of a part of the network:

- Tashkent Junction,
- Tashkent Area line sections,
- Khavast,
- Kokand,

- Samarkand,
- Bukhara,
- Karshi,
- Termez,
- Urgentch,
- Kungrad.

Each division has its own central workshop for repairing and a special team for signalling relay planned maintenance.

Telecommunications and signalling staff belong to the same department. The staff of these divisions varies between 150 and 500 people. The total is 3,228 employees for the signalling and telecommunications department (4% of total railway staff - 80,000 employees).
For the whole network the ratio is 0.88 employees per km of line.
The staff is composed of:

* 11% engineers,
* 48% technicians,
* 41% workers.

For training there is a railway technical school at Tashkent which offers several courses in different specialities: automatism, electromechanical, radio, transmission, etc.

4.1.5.3.3 Maintenance budget

The present operational budget for the signalling and communications department is approximately 473,000,000 UZS per year (7,800,000 USD).

It includes the following:

* Salaries	170,000,000 UZS	35.94%
* Charges	68,000,000 UZS	14.38%
* Material purchases	24,000,000 UZS	5.07%
* Factory repairs	41,000,000 UZS	8.67%
* Energy expenses	100,000,000 UZS	21.14%
* Structure and others	70,000,000 UZS	14.8%

The monthly average salary for technical staff is 4,400 UZS (72.5 USD). Charges paid by the railway to the state represent 40% of the salaries.

The yearly budget represents 2,139 USD per km of line.

This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

4.1.5.4 Signalling equipment

4.1.5.4.1 Equipment description

Station equipment

The network is equipped with two types of Russian equipment:

- before 1978 type, about 40% of the network,
- after 1978 type, about 60% of the network.

Central Traffic Control

These installations are of three types:

- NEVA technology (5) installed in mid 70's,
- LUTCH type (7) installed in mid 80's,
- DIALOGUE type (1); recently, one NEVA CTC has been replaced by the new computerised system and a further replacement is in process.

4.1.5.4.2 Present status of various equipment

The present signalling system on the line is appropriate for the current level of train service and it would be possible to handle much more traffic if necessary.

Station equipment and block system

The equipment installed before 1978 represent 40% of the total equipment installed, most of which were installed 30 or 35 years ago. Maintaining it in good condition is a real problem. It has reached the limit of its life cycle and will be more and more difficult to maintain in the next few years, with heavy consequences for train operations.

There is an increasing number of signalling failures. During the year 1996, 2,158 failures of 3 hours average duration were registered for the whole network.

In each regional centre, there is a signalling workshop which cyclically tests and verifies all the relays, approximately 100,000 are tested every year.

During the last five years, nothing has been bought as replacement parts. The maintenance department is very concerned by the fact that the spare parts reserve may not be sufficient for their needs.

Central Traffic Control

For the NEVA type, the components are no longer manufactured and the only way to maintain these installations is to use equipment parts which have been removed from another location. They have planned to replace these components one by one, the only issue of concern is whether the necessary budget will be available.

Power supply equipment

A large part of the installations are backed by means of batteries, a large percentage of which are in very poor condition. It is important to plan their total replacement during the next five years.

4.1.5.4.3 Measures to be taken

Because of the present level of the maintenance performed, it is possible to keep in operation about 60% of the existing installations for 15 more years , if investment is sufficient to buy spare parts, instrumentation and tools. The maintenance department has neither vehicles (rail and road) nor heavy equipment.

The present reserve of spare parts will not be sufficient for long, **it is urgent to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term**. It is difficult to know for how long Russia will still supply this type of equipment, which is why it is so important to purchase it urgently.

For the 40% of the installations over 30 years old, there is no other solution than to plan their replacement in the short term especially on the TRACECA corridor. All these installations should be used as spare parts for the secondary lines. The replacement concerns 31 station equipments, 340 km of automatic block and Central Traffic Control equipment (approximately 50% of TRACECA corridor)

4.1.5.4.4 Estimation of investment needed

As an emergency measure during the next five years for day to day signalling maintenance, **it is important to invest approx. 2,000,000 USD minimum.** This includes 1,000,000 USD to buy vital spare parts, and 1,000,000 USD for vehicles, trolleys, lorries, tools and instrumentation.

Some stations on main lines need to be rehabilitated in the next few years, in order to maintain an acceptable level of train operations. **The estimated cost for rehabilitation of these stations is 11,400,000 USD.**

Details of the needs:

- New station signalling equipment: 17 small stations, 12 medium stations and 2 large stations
- Installation of 7 new hot box detectors along the main corridor
- New automatic block for 340 km
- New Central Traffic Control for 340 km

Estimated cost for rehabilitation: **11,400,000 USD**

- Supply of equipment: 7,500,000 USD

- Installation: 2,300,000 USD
- Spare parts & tools: 1,200,000 USD
- Training & measurement: 230,000 USD

4.1.5.5 Telecommunications equipment

4.1.5.5.1 Equipment description

Transmission backbone

The open wire lines make up over 80% of the total transmission links. For the TRACECA corridor they account for 60% of the line.

The other line sections are equipped with buried cables supporting multiplex systems and audio-frequency circuits.

For the main transmission routes, several K 60-P systems are used (X times 60 channels), most of them were installed around 1972.

Last year, the Railway had prepared a project considered to be a priority:

* installation of an optical cable with digital 34 Mbits/s equipment between Tashkent and Samarkand,

The project estimate was 5.3 Million USD. Due to the lack of money, nothing has been done.

PABX (administrative telephones)

The automatic telephone network is composed of 25 PABX giving a total capacity of 30,000 subscribers. Only 90% of the subscribers are wired - 27,000 subscribers connected. The whole network offers a ratio of one telephone line for 2.96 people.

The majority of inter-railway long distance communications is handled through operators and manual patch-boards.

Last year, the Railway prepared a project for the replacement of the main PABX in Tashkent station. The project estimate was 1.5 Million for the PABX. Due to the lack of money, nothing has been done.

4.1.5.5.2 Present status of various equipment

Transmission backbone

The open wire line systems have been discontinued world-wide. In general these systems are noisy, subject to external disturbances, limited in channel capacity and do not allow high speed rate data transmission.

All the multiplex for open wire line are of obsolete technology and not manufactured any more. Thus, it is not possible to find any spare parts.

Dispatching party line (operating telephones)

Part of these equipments are from the 1960 generation and need to be replaced by new ones, it can be said that 50 stations need new telephone consoles and 4 dispatcher main concentrators should be replaced.

Radio equipment

Some fixed radio bases for train/dispatcher radio need to be replaced, as well as fixed radios and hand-held radios for shunting purposes in large stations.

PABX (administrative telephones)

The automatic telephone network presents three major problems:

- the poor quality of the lines in some parts of the network,
- the lack of trunk lines between PABX,
- the difficulty to maintain the oldest PABX.

The first two problems affect the transmission backbone; the open lines are adapted to high quality of speech and the capacity of some transmission sections does not allow for sufficient trunk lines.

This could be improved by the replacement of open wire lines and multiplex equipment.

The third problem could be solved only by the replacement of all the old Step-by-Step PABX. These have not been manufactured for many years and it is impossible to find spare parts.

4.1.5.5.3 Measures to be taken

It is very difficult for the maintenance staff to perform their tasks with the existing tools and instrumentation (many of which are badly damaged). The present budget for purchasing small material, instrumentation and tools is not sufficient to meet present needs, it must be increased to allow for repair of faulty equipment.

For the older installations over 30 years old, there is no other solution than to plan their replacement in the short term especially on the main corridors. All these removed installations should be used later, as spare parts for the secondary lines.

Transmission backbone

It is a priority to remove all open wire lines, specially along all the main corridors. The main corridors need to be fully renovated, approximately 732 km of line.
These lines should be equipped with optical cable and digital transmission equipment for long distance needs and with a copper cable for permanent way distribution (signalling

circuits between stations and block sections). The two cables should be self-supported cables and could be mounted on existing poles.

The optical cable could be composed of 10 fibres:

- 4 fibres for double loop configuration SDH network,
- 2 spare fibres for railways needs,
- 4 fibres to be leased to the National Public Telephone network.

The revenues from leased fibres will cover the maintenance costs of the cable and transmission equipment.

Along these lines the existing analogue carrier-frequency systems will be replaced by digital SDH system (STM-1: 155 Mbits/s).

Dispatching party line (operating telephones)

About 40 stations need new telephone consoles and 3 dispatcher central concentrators are required with digital technology.

Radio equipment

As a first step, it is recommended to replace 40 fixed radio bases and 20 on-board equipment for train/dispatcher radios, 20 fixed radios and 50 hand-held radios for shunting purposes in large stations.

Removed radios will be used as component and accessories reserve for radio repair shops.

PABX (administrative telephones)

More than a third of the existing PABX are too old and need to be replaced. There are several PABX to be replaced corresponding to approximately 10,000 subscribers.
Digital exchanges must be installed instead of the existing ones.

4.1.5.5.4 Estimation of investment needed

As an emergency measure for day to day telecommunication maintenance, **it is important to invest approx. 500,000 USD minimum.**

The TRACECA corridor needs to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations.

In addition, parts of the remaining communications equipment need to be replaced, because they cannot be used any longer.

The total estimated costs needed for telecommunications rehabilitation is about 14,400,000 USD.

Details of needs are given below:

Replacement of transmission backbone for TRACECA corridor

Details of the needs:

- Installation of 732 km of optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and 450 km of copper cable for permanent way distribution

Estimated cost for rehabilitation:	**10,400,000 USD**
• Supply:	7,000,000 USD
• Installation:	2,000,000 USD
• Spare parts & tools:	1,000,000 USD
• Training & measurement:	400,000 USD

Replacement of operating telephones (dispatcher)

Details of the needs:

- Replacement of 40 station operator consoles and 3 main dispatching system concentrators

Estimated cost for rehabilitation:	**450,000 USD**
• Supply:	300,000 USD
• Installation:	90,000 USD
• Spare parts & tools:	45,000 USD
• Training & measurement:	15,000 USD

Replacement of radio equipment

Details of the needs:

- Replacement of 40 fixed base radios and 20 on-board equipment for train/dispatcher radio system (including cables and antenna).
- Replacement of 20 fixed base radios (including cables and antenna) and 50 hand-held radios (with spare batteries) for shunting radio system.

Estimated cost for rehabilitation:	**760,000 USD**
• Supply:	500,000 USD
• Installation:	150,000 USD
• Spare parts & tools:	80,000 USD
• Training & measurement:	30,000 USD

PABX replacement (administrative telephones)

Details of the needs:

- 1 PABX of 6500 lines
- 4 PABX of 500 to 1000 lines

- 1 PABX of 1000 to 2000 lines
- (including all telephone sets, distribution cables and connectors)

Estimated cost for replacement:	**2,700,000 USD**
• Supply:	1,800,000 USD
• Installation:	540,000 USD
• Spare parts & tools:	240,000 USD
• Training & measurement:	120,000 USD

4.1.5.6 Overhead catenary system (O.C.S.)

4.1.5.6.1 Equipment description

About 353 km of lines are electrified (9.7% of the network). This amounts to approximately 1,000 km of catenary wire.

It was not possible to obtain exact figures for electrification.

4.1.5.6.2 Present status of various equipment

The Uzbekistan's O.C.S. is the same as Kazakstan's. The comments made by the Systra expert in Kazakstan can be applied to the Uzbekistan network. Several items of equipment are deficient and need to be replaced in the short term, to avoid any serious outage. This concerns mainly transformers, switches and protections. Also, as a normal maintenance cycle, it is necessary to replace contact and messenger wires where the most wear occurs (mostly switching areas in station and yards).

The technology used for switches, command/control, remote and protection equipment is now obsolete.

For local control frames in substations and switching points and for remote control systems, it is important to plan their total replacement in the medium term (10 years). They are obsolete and their maintenance will become more and more difficult in the years to come.

4.1.5.6.3 Measures to be taken

O.C.S. of this network represents only 10% of the Kazakstan network. Equipment to be replaced in the short term has been estimated at 10% of Kazakstan needs.

Necessary measures and investment for finalising electrification on sections to Samarkand as well as further plans (Samarkand - Bukhara) have not been assessed (there will be separate projects to investigate).

4.1.5.6.4 Estimation of investment needed

Some vital parts of the O.C.S. need to be replaced in the next few years, in order to maintain an acceptable level of train operations.

In addition, parts of the mechanical equipment (wires and accessories) need to be replaced, because they have reached their limits of wear.

The total estimated costs for O.C.S. rehabilitation is about 2,350,000 USD.

Details of needs for these sections are given below:

Replacement of faulty equipment in substations

Details of the needs:

- Refurbishing of main damaged transformers.
- Replacement of surge arrestors, HF oil type switches, 25 kV switches and impedance catenary protections.

Estimated cost for rehabilitation:	**2,100,000 USD**
• Supply:	1,400,000 USD
• Installation:	420,000 USD
• Spare parts & tools:	210,000 USD
• Other expenses:	70,000 USD

Maintenance of catenary

Details of the needs:

- Replacement of contact wire and messenger,
- Replacement of glass insulators, section insulators, anchoring devices and droppers.

Estimated cost for rehabilitation:	**250,000 USD**
• Supply:	160,000 USD
• Installation:	50,000 USD
• Spare parts & tools:	30,000 USD
• Other expenses:	10,000 USD

4.1.5.7 Conclusion

The site visits by the Consultant show that:

Signalling equipment:

The present reserve of spare parts will not be sufficient for long, **it is urgent to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term.**

As an emergency measure **it is important to invest approx. 2,000,000 USD minimum** during the next five years for day to day signalling maintenance. This includes 1,000,000 USD to buy vital spare parts, and 1,000,000 USD for vehicles, trolleys, lorries, tools and instrumentation.

For the 40% of installations over 30 years old, there is no other solution than to forecast their replacement in the short term especially on the TRACECA corridor. All these installations should be used as spare parts for the secondary lines. The replacement concerns 31 station equipments, 340 km of automatic block and Central Traffic Control equipment (approximately 50% of TRACECA corridor). **The estimated cost for rehabilitation of these stations is 11,400,000 USD.**

Telecommunications equipment:

As an emergency measure for day to day telecommunication maintenance, **it is important to invest approx. 500,000 USD minimum.**

For the older installations over 30 years old, there is no other solution than to plan their replacement in the short term especially on the main corridor. All these removed installations should be used later, as spare parts for the secondary lines.

It is a priority to remove all open wire lines, especially all along the main corridor. The main corridor needs to be fully renovated, approximately 732 km of line.

The total estimated cost needed for telecommunication rehabilitation is about 14,400,000 USD.

O.C.S.:

Some vital parts of the O.C.S. need to be replaced in the next few years, in order to maintain an acceptable level of train operations. In addition, part of the mechanical equipment (wires and accessories) needs to be replaced, because they have reached their limits of wear.

The total estimated cost for O.C.S. rehabilitation is about 2,350,000 USD.

4.1.6 Turkmenistan

4.1.6.1 Railway network

The Turkmenistan railway network is composed of 2,312 km of lines:

- 33 km of double-track lines,
- 2,279 km of single-track lines.

A new 130 km section of line was opened in 1995 between Tedzhen and Sarakhs (Iran border).

Another 210 km section of line is under construction between Chardzhev and Kerki, 35 km are already finished, provisional opening date is 10/98.

There are no electrified lines.

All lines are equipped with an automatic or semi-automatic block system. Approximately 55% of lines (1275 km) are equipped with automatic block and are under centralised traffic command.

The network is composed of 171 stations including 142 stations equipped with electric switch points.

- 139 small stations (under 15 switches)
- 23 medium stations (15 to 60 switches)
- 9 large stations (over 60 switches)

The terminal station of Krasnovodsk on the Caspian Sea was never equipped with electric switch points, due to a water level problem. The tracks are often flooded.

The average distance between stations is about 10-15 km.

TRACECA corridor

The total length of this corridor is 1,314 km of line which represents 57% of the whole network.

4.1.6.2 Consultant visit details

From the 1st to the 7th of June 1997 several meetings were organised in Ashgabat, with all the Railway executives for:

- signalling,
- telecommunications.

For telecommunications and signalling, all equipment rooms, operation centres and workshops were visited in the ASHGABAT area.

During this visit, the principal executives met and interviewed were the following:

- Mr Georgievitch German
  Technical Director of Railways
- Mr Geldymuradov Aman
  Chief of Telecommunication & Signalling Department
- Mr Kudju Alexander
  Deputy Chief of Telecommunication & Signalling Department

4.1.6.3 General information

4.1.6.3.1 Operations main figures

Train operations

All the Turkmenistan network is equipped with light colour signals and block system.

All railway stations and passing loops have at least two passing tracks.

For about 86% of the network, all journeys on the lines and at the railway stations are supervised by a Centralised Traffic Control office (CTC) located at Ashgabat.

Operations within 'station limits' (also within marshalling yards) are exempted from this rule. Shunting traffic at these railway stations is co-ordinated between the station's operator and the dispatcher of the supervisory railway station who also sets up the route and releases the shunting movements and journeys.

The largest stations are locally controlled only. This is due to the very high daily movements required in these stations.

4.1.6.3.2 Organisation and staffing

The General Railway's Headquarters are located at Ashgabat.

The network is divided into 5 regional centres which are in charge of a part of the network:

- Ashgabat,
- Amudarya,
- Chardzhev,
- Mary,
- Turkmenbashi.

Telecommunications and signalling staff belong to the same department. About 1,790 people are working for the signalling and telecommunications department (8.5 % of total railway staff -21,000 people).

For the whole network, the ratio is 0.77 persons per km of line.

The staff is composed of:

* 9% engineers,
* 15% technicians,
* 76% workers.

4.1.6.3.3 Maintenance budget

The present operating budget for the signalling and communications department could not be found.

The present monthly average salary for technical staff is:

220,000 TMM (42 USD).

Charges and taxes paid by the Railways to the state represent:
50% of the salary.

It is only possible to estimate what the yearly budget should be in normal conditions:
14,000 Million TMM approximately 2.7 Million USD.

This estimated budget includes the following:

* Salaries	4,726 Million TMM	33.54%
* Charges and taxes	2,362 Million TMM	16.77%
* Material and spare parts	1,600 Million TMM	11.36%
* Energy expenses	2,900 Million TMM	20.58%
* Structure and others	2,500 Million TMM	17.75%

This yearly budget represents 1,161 USD per km of line.

4.1.6.4 Signalling equipment

4.1.6.4.1 Equipment description

Station equipment

The stations were mainly equipped between 1968 and 1975.

Central Traffic Control

There are 8 CTC equipment of two types:

- seven items of equipment, NEVA type (1970) which is the oldest one.
- one equipment, LUTCH type, which is more recent (1980) and uses only electronic cards.

Last year, ALCATEL (German branch) submitted a proposal for the replacement of all CTC equipment. Their technical proposal was based on a computerised system and three regional centres, at Ashgabat, Krasnovodsk and Chardzhev, instead of one as at present. All existing signalling equipment was to be kept, only necessary interfaces would be provided.

The 21 Million USD financial proposal was not accepted by the Railways.

4.1.6.4.2 Present status of various equipment

The present signalling system on the line is appropriate for the current level of train service, and could handle much more traffic than at present if necessary.

Station equipment and block system

All equipment for interlocking and safety are based on the relay technology of the 50's. This technology is obsolete but uses robust equipment which is easy to maintain. All equipment installed after 1978 can last for many years.

The oldest ones have reached the limit of their life cycle and they will be more and more difficult to maintain in the next few years, with heavier consequences for train operations.

There is an increasing number of signalling failures. During the year 1996, 2,000 failures were registered for the whole network, of $3^{1/2}$ hours average duration.

In each regional centre, there is a signalling workshop which cyclically tests and verifies all the relays.

During the last five years, nothing has been bought as replacement parts. The maintenance department is deeply concerned by the fact that the spare parts reserve may not be sufficient for their future needs.

Central Traffic Control

For NEVA type, the components are no longer manufactured and the only way to maintain these installations is to use equipment parts which have been removed from another location. During the next 10 years, a problem will arise when all spare parts presently available will be used up.

For LUTCH type, it is still possible to buy spare parts.

Power supply equipment

A large part of the installations are backed by means of batteries, which are for a large percentage in very poor condition. It is important to plan their total replacement during the next five years.

4.1.6.4.3 Measures to be taken

Owing to the present level of the maintenance performed, it is possible to keep about 70% of the existing installations in operation for another 15 years, if investment is sufficient to buy spare parts, instrumentation and tools.

The present reserve of spare parts will be not sufficient for long, **it is urgent to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term**.

This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

The TRACECA corridor needs to be improved, as a first step action, in all line sections which are not equipped with CTC. The existing equipment is too old and there is no other solution than to plan their replacement in the short term. All these removed installations should be used as spare parts for the secondary lines.

4.1.6.4.4 Estimation of investment needed

As an emergency measure during the next five years for day to day signalling maintenance, **it is important to invest 750,000 USD minimum to buy vital spare parts, tools and instrumentation.**

Some sections of the TRACECA corridor need to be rehabilitated in the next few years, in order to maintain an acceptable level of train operations. **The estimated cost for rehabilitation of these sections is 18,000,000 USD.**

Details of the needs on these sections are given below:

TRACECA corridor
Dushak to Ashgabat (169 km)
Bami to Krasnovodsk (391 km)

Details of the needs:

- New station signalling equipment: 40 small stations, 5 medium stations and 3 large stations
- New automatic block
- Central Traffic Control for the sections

Estimated cost for rehabilitation:	**18,000,000 USD**
• Station equipment:	7,200,000 USD
• Block equipment:	3,900,000 USD
• Central command:	900,000 USD
• Installation:	3,600,000 USD
• Spare parts & tools:	1,800,000 USD
• Training & measurement:	600,000 USD

4.1.6.5 Telecommunication equipment

4.1.6.5.1 Equipment description

Transmission backbone
The open wire lines make up over 78% of the total transmission links, approx. 1,800 km. The other sections of lines (520 km) are equipped with buried cables supporting multiplex systems and audio-frequency circuits.

Tacis
This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

For the main transmission routes, several K 60-P systems are used (X times 60 channels); most of them were installed around 1980.

Radio equipment

For train/dispatcher radio, there are 171 fixed radio bases and 330 on-board radio equipment.

Approximately 30 stations are equipped with shunting radios.

PABX (administrative telephones)
The automatic telephone network is composed of 32 PABX giving a whole capacity of 10,200 subscribers. Only 90% of the subscribers are wired. 9,200 subscribers connected. The whole network offers a ratio of one telephone line for 2.28 people.

The different technologies of PABX are distributed as below:

- 28% of Step-by-Step (1970)
- 38% of Electromechanical (1980),
- 34% of Electronics (1990).

The majority of inter-railway long distance communications is handled through operators and manual patch-boards.

4.1.6.5.2 Present status of various equipment

Transmission backbone

The open wire line systems have been discontinued world-wide. In general these systems are noisy, subject to external disturbances, limited in channel capacity and do not allow high speed data transmission.

All the multiplex for open wire line are of obsolete technology and no longer manufactured. Thus, it is not possible to find any spare parts.

Dispatching party line (operating telephones)

In the last five years, part of this equipment has been replaced by new equipment. Same technology as previously, obsolete but reliable.

Radio equipment

Some fixed radio bases for train/dispatcher radio need to be replaced, as well as fixed radios and hand-held radios for shunting purposes in large stations.

PABX (administrative telephones)

The automatic telephone network presents three major problems:

- the poor quality of the lines in some parts of the network,
- the lack of trunk lines between PABX,
- the difficulty to maintain the oldest PABX.

The Railways are in the process of transferring all their PABX to Telephone Companies. The administrative telephone network will belong to an external operator.

It is not clear today how this will work. For the main cities, it will not be a problem, but for small stations it seems that the telephone companies do not know what to do. Maybe only a part of the network will belong to the operator. Nothing can be planned for the replacement of the oldest ones (step by step - approximately 3,000 lines) until the situation is cleared.

4.1.6.5.3 Measures to be taken

It is very difficult for the maintenance staff to perform their tasks with the existing tools and instrumentation (a lot of these are badly damaged). The present budget for purchasing small material, instrumentation and tools is not sufficient for their needs, it must be increased to allow for repair of faulty equipment.

For the open wire backbone along the TRACECA corridor, there is no other solution than to plan their replacement in the short term. All these removed installations should be used later, as spare parts for the secondary lines.

Transmission backbone

It is a priority to remove all open wire lines.
The main line sections to be renovated are the following:

- Ashgabat to Nebit-Dag (400 km)
- Dushak to Farap / Uzbekistan border (440 km)

These sections of line should be equipped with optical cable and digital transmission equipment for long distance needs and with a copper cable for permanent way distribution (signalling circuits between stations and block sections). The two cables should be self-supported cables and could be mounted on existing poles.

The optical cable could be composed of 10 fibres:

- 4 fibres for double loop configuration SDH network,
- 2 spare fibres for railways needs,
- 4 fibres to be leased to the National Public Telephone network.

The revenues from fibres leased will cover the maintenance costs of the cable and transmission equipment.

Along these lines the existing analogue carrier-frequency systems will be replaced by digital SDH system (STM-1: 155 Mbits/s).

Radio equipment

As a first step, it is recommended to replace 30 fixed radio bases and 20 on-board equipments for train/dispatcher radio, 10 fixed radios and 20 hand-held radios for shunting purposes in large stations. Removed radios will be used as component and accessories reserve for radio repair shops.

4.1.6.5.4 Estimation of investment needed

To perform the daily maintenance tasks, **it is urgent to invest 500,0000 USD for new instrumentation and various tools in the short term.**

Some sections of TRACECA corridor need to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations.

In addition, part of the remaining communications equipment needs to be replaced, because it cannot be used any longer.

The total estimated cost for telecommunication rehabilitation is about 15,000,000 USD.

Details of needs for these sections are given below:

Replacement of transmission backbone

Details of the needs:

- Replacement of 840 km of open wire lines by optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and copper cable for permanent way distribution

Estimated cost for rehabilitation: **14,500,000 USD**

- Supply: 9,800,000 USD
- Installation: 2,900,000 USD
- Spare parts & tools: 1,400,000 USD
- Training & measurement: 400,000 USD

Replacement of radio equipment

Detail of the needs:

- Replacement of 30 fixed base radios and 20 on-board equipment for train/dispatcher radio system (including cables and antenna).
- Replacement of 10 fixed base radios (including cables and antenna) and 20 hand-held radios (with spare batteries) for shunting radio system.

Estimated cost for rehabilitation: **520,000 USD**

- Supply: 350,000 USD

- Installation: 100,000 USD
- Spare parts & tools: 50,000 USD
- Training & measurement: 20,000 USD

4.1.6.6 Line electrification

There is no electrified line on this railway network.

The Turkmen government has first ideas to start the electrification within the next few years with the Ashgabat junction (at first for suburban traffic with EMU's only). Detailed plans are not yet existing.

4.1.6.7 Conclusion

The site visits by the Consultant show that:

Signalling equipment:

The present reserve of spare parts will not be sufficient for long, **it is urgently necessary to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term.** As an emergency measure during the next five years, **it is important to invest 750,000 USD minimum to buy vital spare parts, tools and instrumentation** for day to day signalling maintenance.

The TRACECA corridor needs to be improved in all line sections which are not equipped with CTC as a first step action. The existing equipment is too old and there is no other solution than to plan their replacement in the short term. All these removed installations should be used as spare parts for the secondary lines. **The estimated cost for rehabilitation of these sections is: 18,000,000 USD.**

Telecommunications equipment:

To perform the daily maintenance tasks, **it is urgent to invest 500,0000 USD for new instrumentation and various tools in the short term.**

Some sections of TRACECA corridor need to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations. All these removed installations should be used later, as spare parts for the secondary lines. The main sections of lines to be renovated are the following:

- Ashgabat to Nebit-Dag (400 km)
- Dushak to Farap Uzbekistan border (440 km)

The total estimated cost for telecommunication rehabilitation is about 15,000,000 USD.

4.1.7 Tadjikistan

4.1.7.1 Railway network

The Tadjikistan railway network is composed of 440 km of lines:

- 138 km of double-track lines,
- 302 km of single-track lines.

There are no electrified lines.

All lines are equipped with an automatic or semi-automatic block system.

Approximately 24% of lines (106 km) are equipped with automatic block and are under centralised traffic command (all in Fergana valley corridor).

Fergana Valley North Corridor

This corridor links the main part of Uzbekistan with the Fergana valley (Bekabad - Kanibadam). The total length of this corridor is 171 km of line which represents 39% of the whole network.

Branch lines

There are:

- two branch lines in the North of about 64 km for freight traffic only,
- two branch lines in the South of about 205 km to Dushanbe and Kurgan-Tyube.

4.1.7.2 Consultant visit details

It has not been possible to organise a visit in Tadjikistan for the whole expert's team during the limited time of the field mission. A meeting of the leader of the expert's group took place at Khodzhent (main station on the Fergana valley North corridor) with railway executives (Mr Kadyrov Abdukakhor, Head of the Khodzhent Signalling & Telecommunication department and others) who gave information about their network, especially about the North Corridor.

All equipment is of the same type as in the other countries visited. From the discussion, it seems that the problems are very similar to those of other countries.

Estimation of their needs were based on the information received and assumptions applied to other countries.

4.1.7.3 General information

4.1.7.3.1 Operation main figures

Train operations

All the Tadjikistan network is equipped with light colour signals and block system.

All railway stations and passing loops have at least two passing tracks.

There is not any Centralised Traffic Control (CTC).

4.1.7.3.2 Organisation and staffing

The General Railway's Headquarters are located at Dushanbe.

The network is divided into 2 regional centres which are in charge of a part of the network:
- Khodzhent for the North (Fergana Valley corridor plus two branch lines),
- Dushanbe for the South (two branch lines).

Telecommunications and signalling staff belong to the same department. About 102 people are working for the Signalling and Telecommunications Department in the North.

The level of qualifications of the staff is very low. Of the 102 people working in the North, only 2 are engineers and 30 are more or less technicians.

4.1.7.3.3 Maintenance budget

The present operating budget for the Signalling and Communications Department could not be found.

The present monthly average salary for technical staff is:
14,210 Tadjik Roubles (29 USD).

Charges and taxes paid by the Railways to the state represents:
40% of the salary.

4.1.7.4 Signalling equipment

4.1.7.4.1 Present status of various equipment

The present signalling system on the North Corridor line is appropriate for the current level of train service, and could handle much more traffic than today if necessary.

Station equipment

Signal boxes in the stations for the western part of the North Corridor (Bekabad - Khodzhent) were renewed 4 years ago, the eastern part is 27 years old.

All equipment for interlocking and safety are based on relay technology of the 50's.
The oldest ones have reached the limit of their life cycle and they will be more and more difficult to maintain in the next few years, with heavier consequences for train operations.

During the last five years, nothing has been bought as replacement parts. The maintenance department is deeply concerned by the fact that the spare parts reserve may not be sufficient for their future needs.

Block system

In the North, 106 km of lines are equipped with automatic block system, 51 km of these were installed in 1993, the rest were installed in the 70's.

In the South, only small sections are equipped with automatic block system. The other sections are equipped with the old semi-automatic block system.

4.1.7.4.2 Measures to be taken

The present reserve of spare parts will not be sufficient for long, **it is urgent to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term.**

The North Corridor needs to be improved in the section which is not equipped with Automatic block as a first step action. All the removed installations should be used as spare parts for the secondary lines.

4.1.7.4.3 Estimation of investment needed

As an emergency measure during the next five years for day to day signalling maintenance, **it is important to invest 250,000 USD minimum to buy vital spare parts, tools and instrumentation.**
A 65 km section of the North Corridor needs to be rehabilitated in the next few years, in order to maintain an acceptable level of train operations. **The estimated cost for rehabilitation of this section is 2,200,000 USD.**

Details of needs for these sections are given below:

- New station signalling equipment: 4 small stations and 2 medium stations
- New automatic block system

Estimated cost for rehabilitation: **2,200,000 USD**

- Station equipment: 1,000,000 USD
- Block equipment: 450,000 USD
- Installation: 440,000 USD
- Spare parts & tools: 210,000 USD
- Training & measurement: 100,000 USD

4.1.7.5 Telecommunication equipment

4.1.7.5.1 Equipment description

Transmission backbone

All the network is equipped with open wire lines. Most of them were installed 30-40 years ago (except the western part of the Fergana Valley corridor where the open wire lines were installed 6-8 years ago).

There is no direct railway connection between the North and the South. Communications are via 3 channels leased from the Public Network and one channel via Uzbek Railway (Tashkent).

Radio equipment

For train/dispatcher radio, all stations and locomotives were equipped 10 years ago.

PABX (administrative telephones)

The automatic telephone network for the North corridor is composed of:

- 2 PABX of 200 lines at Khodzhent (4 years old),
- 1 PABX of 50 lines at Kanibadam (3 years old),
- 1 PABX of 100 lines in Isfara (6 years old).

The majority of inter-railway long distance communications are handled through operators and manual patch-boards.

4.1.7.5.2 Present status of various equipment

Transmission backbone

The open wire line systems have been discontinued world-wide. In general these systems are noisy, subject to external disturbances, limited in channel capacity and do not allow high speed rate data transmission.

All the multiplex for open wire line are of obsolete technology and no longer manufactured. Thus, it is not possible to find any spare parts.
Dispatching party line (operating telephones)

In the last five years, part of this equipment has been replaced by new equipment.

Radio equipment

In good condition

PABX (administrative telephones)

In good condition

4.1.7.5.3 Measures to be taken

It is very difficult for the maintenance staff to perform their tasks with the existing tools and instrumentation (a lot of these are badly damaged).

For the open wire backbone along the Northern Corridor, there is no other solution than to plan their replacement in the short term. All these removed installations should be used later, as spare parts for the other lines.

Transmission backbone

It is a priority to remove all open wire lines along the Northern Corridor.
These sections of line should be equipped with optical cable and digital transmission equipment for long distance needs and with a copper cable for permanent way distribution (signalling circuits between stations and block sections). The two cables should be self-supported cables and could be mounted on existing poles.

The optical cable could be composed of 10 fibres:

- 4 fibres for double loop configuration SDH network,
- 2 spare fibres for railways needs,
- 4 fibres to be leased to the National Public Telephone network.

The revenues from fibres leased will cover the maintenance costs of cable and transmission equipment.

Along these lines, the existing analogue carrier-frequency systems will be replaced by digital SDH system (STM-1: 155 Mbits/s).

4.1.7.5.4 Estimation of investment needed

To perform the daily maintenance tasks, **it is urgent to invest 100,0000 USD for new instrumentation and various tools in the short term.**

The Northern Corridor needs to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations.

The total estimated cost for telecommunication rehabilitation is about 3,000,000 USD.

Details of needs for these sections are given below:

- Replacement of 171 km of open wire lines by optical cable for long distance transmission (including all digital multiplex and power supply equipment with batteries) and copper cable for permanent way distribution

Estimated costs for rehabilitation:	**3,000,000 USD**
• Supply:	2,000,000 USD
• Installation:	600,000 USD
• Spare parts & tools:	300,000 USD
• Training & measurement:	100,000 USD

4.1.7.6 Line electrification

There is no electrified line on this railway network.

In Soviet times, a project of electrification between Tashkent and Dzhizak and the Fergana Valley had been started. The works were stopped at the Uzbek border station Bekabad. Thus, the Northern corridor is not electrified, even if some parts of the works were started (e.g. catenary supports for station tracks), the substations were never built.

Today, Tadjikistan has no funds and is not interested in resuming these works, principally due to the fact that there are no energy resources in the North.

4.1.7.7 Conclusion

The investigations of the Consultant show that:

Signalling equipment:

The present reserve of spare parts will not be sufficient for long, **it is urgent to buy a stock of spare parts** (switching point motors, safety relay, batteries, etc.) **in the short term.** As an emergency measure during the next five years, **it is important to invest 250,000 USD minimum to buy vital spare parts, tools and instrumentation** for day to day signalling maintenance.

As a first step action the Northern Corridor needs to be improved in the section which is not equipped with CTC. The existing equipment is too old and there is no other solution than to plan for its replacement in the short term. All these removed installations should be used as spare parts for the secondary lines. **The estimated cost for rehabilitation of these sections is about 2,200,000 USD.**

Telecommunications equipment:

To perform the daily maintenance tasks, **it is urgent to invest 100,0000 USD for new instrumentation and various tools in the short term.**

The Northern corridor needs to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations. All these removed installations should be used later as spare parts for the secondary lines.

The total estimated cost for telecommunications rehabilitation is about 3,000,000 USD.

4.2 Permanent Way, Bridges

4.2.1 Existing Conditions of Infrastructure Maintenance

4.2.1.1 Network

In all countries participating in this project the track gauge amounts to 1,520 mm and the axle load to 23 tons.

In all countries of this region the maximum admissible speed for passenger trains is 100 km/h and that for freight trains 90 km/h.

4.2.1.1.1 Kazakstan

The railway network in Kazakstan is relatively wide-mashed. Because of the size of the country, this however amounts to 13,419 km of track. 8,308 km thereof are single track, 5,078 km double track and 33 km three tracks. The length of the main tracks is 18,637 km.

The traffic density of the lines amounts to :

traffic density in million tons per year	length of line in km		
	total length	thereof	
		single-track line	double-track line
secondary lines	2,300 km	2,300 km	
less than 5 million t/year	5,600 km	5,500 km	100 km
5 - 10 million t/year	3,100 km	1,300 km	1,800 km
10 - 15 million t/year	1,000 km		1,000 km
15 - 20 million t/year	700 km		700 km
more than 20 million t/ year	700 km		700 km

The track sections that are most frequented are in North Kazakstan. These are the following lines:

Karaganda - Akmola - Kokshatav - Novoishimskaya - Kurgan (Russia)
Kartaly (Russia) - Tobol - Akmola - Pavlodar - Kulunda (Russia)
Kokshatav - Kzyl Tu - Karasuk (Russia)

The most important transit routes are:

TRACECA: Druzhba - Aktogay - Almaty - Tchimkent - Tashkent (Uzbekistan) Turkmenistan - Europe
Druzhba - Aktogay - Mointy - Akmola - Kokshatav - Novoishimskaya - Kurgan (Russia) - Europe
Tashkent (Uzbekistan) - Kzyl Orda - Kandagatch - Aktyubinsk - Russia

This means that the new transit routes towards Europe do not always correspond to the most frequented track sections. Thus, there are track sections along the transit routes that will have to be extended in case of an increase in total transport.

There are already plans for the construction of new lines, as e.g.: Dzhezkazgan - Kzyl Orda and Uzen - Turkmenistan. Since there are practically no towns or industry along both new lines, these lines would be only used for transit. Another project is the electrification and the laying of a second track on the line Almaty towards Shu. This is the last single-track, non-electrified section between Almaty and Tashkent.
By shifting the capital from Almaty to Akmola, the line between these two cities will gain importance. It is planned to increase the maximum speed of this line to 140 km/h.

4.2.1.1.2 Kyrgyzstan

The total length of line to be maintained by Kyrgyzstan amounts to 424.6 km.
All lines are single track with diesel traction.

Because of the complicated border line to the neighbouring countries as well as the topography of the country, the line network is incoherent with much long-haul traffic on the corridors. Within Kyrgyzstan, the Northern part with its centre in Bishkek is not connected to the Southern part with the centre in Osh, they are separated by the alpine region of Kyrgyz Altau. If the mountain chain is bypassed, this means a detour of about 1,000 km via the lines of Kazakstan, Uzbekistan and Tadjikistan crossing nine times a state border. On the other hand, the Southern part of the railway network is made up of three short spurs which all come from the neighbouring country Uzbekistan, without being connected to one another. As regards the Northern part of the network, it was agreed upon with the Kazaks to exchange two operating sections. Thus, the Kazaks handle a corridor in Kyrgyzstan, and the Kyrgyz a track section in Kazakstan from the branch-off station Lugovaya in Kazakstan up to the state border.

The traffic density of all lines is below 5 million tons/year, in detail:

Dzhambul - Bishkek	145 km	1 million t/year
Bishkek - Bystrovka	96 km	0.2 million t/year
remaining lines	183.6 km	0.07 million t/year

In Kazakstan, the line from Lugovaya to Bishkek shall be electrified. The Kyrgyz give this project high priority, since on the one hand power is very cheap and on the other hand diesel is very expensive. It would be necessary to execute an economic analysis.

Two new railway lines are discussed. One would be a north-south connection within Kyrgyzstan. This line would have to surmount an alpine region with summits of up to 5000 m or heights of passes of 3000 m. The second new line would be a railway connection to China. This line would be a cross connection from Uzbekistan (Fergana Valley) via the region of Osh to China (in China, a railway line to the border is planned and partly already under construction). The line runs through extremely difficult terrain, a financial contribution by Kyrgyzstan seems to be impossible. As for Kyrgyzstan, this would be only a rather short transit route. Especially China and Uzbekistan are interested in this line.

4.2.1.1.3 Uzbekistan

The total length of the railway lines in Uzbekistan amounts to 3,655 km. 683 km thereof are double track. This results in a length of main tracks of 4,338 km.
In the south of the country, the TRACECA - corridor runs from east to west as connection between Turkmenistan and Kazakstan and further on to China. About 670 km of this transit route are in Uzbekistan.

The line with the highest traffic volume runs between Samarkand and Dzhizak transporting 40 million tons per year. In Dzhizak, this line parts towards Tashkent and towards Fergana Valley.

1,905 km	less than 5 million t/year
700 km	5 - 10 million t/year
400 km	10 - 20 million t/year
600 km	20 - 30 million t/year
150 km	40 million t/year

As regards extensions of the lines as well as construction of new lines, the TRACECA corridor is given highest priority.

Moreover, there are plans to construct a new railway line of about 500 km in the north of the country, from Nukus to Utchkuduk, since this region is said to dispose of raw material. On the other hand, the cities in the north of the country could be reached without transit route through Turkmenistan.

Also the Fergana Valley with its large industry and the city of Termez at the Afghan border can only be reached via transit routes. Thus, it is considered to construct new lines of about 200 km each.

Of these three regions, only in the Fergana Valley there is big industry. Today, about 28 million tons per year are transported by the railway into this region.

4.2.1.1.4 Turkmenistan

The total length of railway lines in Turkmenistan amounts to 2,313 km. 33 km thereof are double track. Thus, the length of main tracks amounts to 2,346 km.

The TRACECA corridor runs in east-to-west direction from the seaport of Turkmenbashi at the Caspian Sea to Chardzhev, as connection to Uzbekistan and further on to Kazakstan and China. About 1,170 km of this transit route run in Turkmenistan. This track section constitutes the key part of the TRACECA route in Central Asia. Today, in some parts the traffic density of this route amounts to 7 to 14 million tons/year.

The railway lines of 2,313 km of this country have a traffic density of:

247 km	less than 5 million t/year
1.236 km	5 - 10 million t/year
830 km	10 - 20 million t/year

In 1996, the newly constructed, 122 km long line to Sarakhs at the border to Iran was opened.
In the north of the country a connection from Bekdash (Kazak border) - Turkmenbashi (Krasnovodsk) via Kazandzhik (using part of TRACECA) and another 250 km towards Iran is planned. About 25 km of this line have already been constructed.
In the south of the country, the construction of a new line from Chardzhev to Kerki was started, which has a length of about 200 km.

4.2.1.1.5 Tadjikistan

The total length of network is approx. 440 km.

Network geography:

- 1 corridor line in the north: Bekabad - Kanibadam (connecting the main part of Uzbekistan with the Fergana valley)
  2 branch terminal lines in the North, total length 64 km (freight traffic only)
  2 branch lines in the south to Dushanbe and Kurgan-Tyube (not directly connected)
- operation length of the network in the north: 171.3 km
- total length of main tracks in the north 234.5 km
- total length of station tracks in the north 67.5 km
- total length of siding tracks in the north 18.2 km

The line between km 38 and km 100 in the north (Bekabad - Kajrakkum in the east of Chodzhent) is double track.
The traffic density in the north is about 10 pairs of freight trains per day (predominantly Uzbek transit), in the south network it is much smaller.

4.2.1.2 Organisational Structure

4.2.1.2.1 Kazakstan

Since the capital of the country will be shifted from Almaty to Akmola, it was already started with the relocation of the Ministry of Transport and Telecommunications.

In late fall of 1996, the three railway organisations existing in Kazakstan became bankrupt. On January 31, 1997, the Republic State Enterprise Kazakstan Temirzhol was created out of these three organisations (Almaty Railway Administration, Tselinaya Railway Administration and West Kazakstan Railway Administration). The headquarters of RSE-Temirzhol are in Almaty. Since this organisation is new, at present it is difficult to find a person to speak to and to obtain information on Kazakstan as a whole.

There exist 14 district offices. At present, a change or reduction in the number of district offices is not planned. The average section to be supervised is about 960 km.
Each district office is divided into 3 to 8 permanent way and structure districts. In total, there are 60 permanent way and structure districts, the average length of a line per permanent way and structure district amounting to 220 km.

In total, in the section route maintenance, 21,797 persons are employed as workers or in the administration of the permanent way and structure districts. These are also responsible for the maintenance of the bridges. Moreover, there are 28 work trains and permanent way workshop for track machines, respectively, with about 130 persons each. Here, the heavy track-laying machines are located, the staff also operates the machines and constructs the track panel. Thus, slightly over 25,400 persons are employed in the field of route maintenance. This results in an average staff of 1.9 persons per km of track, or. 1.3 persons per km of main tracks. The average salary of a permanent way worker amounts to USD 200 per month.

For detailed lists of the district offices and permanent way shop including staff numbers and operating lengths, see Annex 4.1

4.2.1.2.2 Kyrgyzstan

In contrast to the 3 bigger countries included in this report, the former Soviet Union did not have an own railway administration for Kyrgyzstan. The only organisational unit for track maintenance was a permanent way and structure district in Bishkek (formerly Frunse).

Today, this former permanent way and structure district executes all tasks in the field of track maintenance in the whole of Kyrgyzstan, thus the right term would be infrastructure department. Head of this department is Mr. Kiritchenko. Thus, this newly created department has to analyse and solve the problems which, prior to the independence of Kyrgyzstan, were treated in the general headquarters of the respective railway administrations in Almaty and Tashkent, respectively. This infrastructure department is divided into a permanent way department and a department for civil construction.

In the permanent way department with its chief Mr. Imanbaev, there is only one further organisational unit - the track gangs with about 15 workers each. In Kyrgyzstan, the total number of employees for permanent way including the track machine staff and administrative staff amounts to 545; this results in 1.3 persons per kilometre of main track. All permanent way works are executed with railway personnel - the works include the repair and maintenance of the tools and machines. The average salary of a permanent way worker amounts to USD 180 per month.
The department for other structural installations supervises bridges as well as rising structures. In this department, about 240 persons are employed. Also in this field, the works are done by railway staff only.

4.2.1.2.3 Uzbekistan

The general headquarters named "State Stock Railway Company Uzbekistan" are located in Tashkent. For permanent way, Mr. Khabibulla Abdullaev is the Deputy Head of Permanent Way.

The organisation is divided into in 5 district offices. Thus, each of these district offices has an average operating length of 730 km.

Each district office has between two and four permanent way and structure districts. In total, these are 16 permanent way and structure districts with an average operating length of 230 km length of line or 270 km of main tracks. The district inspector and his staff are also responsible for bridges and structures, with the exception of rising structures.

Moreover, there are 5 permanent-way workshops, housing the heavy track machines as e.g. Platov crane and tom. Each of these workshops employs about 150 workers, who assemble and dissemble track panels in the workshop as well as on the line using the track machines.

At disposal are also special teams for track welding, bridge construction and substructure works. The railway administration owns also a workshop for the production of concrete sleepers as well as a ballast works.

In total, 8,637 persons are employed in the field of permanent way maintenance. 6,200 thereof are rail workers, the others administrative personnel, gang foremen, machine staff and special teams. Thus, per km line 2.3 persons work in the field of permanent way maintenance, or. 2.0 per km of main track. All works, including the sleeper production, are done by railway staff. The average salary of a permanent way worker amounts to USD 20 per month.

Tacis
This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

4.2.1.2.4 Turkmenistan

The general headquarters are located in Ashgabat. As regards the infrastructure (permanent way and bridge construction), Mr. Altijev is the responsible head of department. Mr. Bairamov is responsible for permanent way maintenance and Mr. Khashtekov for structures.

The organisation is divided into 5 district offices, one per district in Turkmenistan.
Each district office has between one and three permanent way and structure districts. In total, there are 10 permanent way and structure districts with an average operating length of 230 km length of line and main tracks, respectively.

Moreover, there are 3 permanent way workshops, housing heavy track machines. In these workshops, also the respective track maintenance works are executed.

In total, about 3,300 persons are employed in the field of permanent way maintenance. 2,800 thereof are workers, the others administrative staff. Thus, per km line 1.4 persons work in the field of permanent way maintenance. The average salary of a permanent way worker amounts to USD 45 per month.

4.2.1.2.5 Tadjikistan

The permanent way department of the Tadjik Railway consists of: 3 Permanent Way Districts (Chodzhent, Dushanbe and Kurgan-Tyube) and one construction train (so called for Track department responsible for track renewal) in Chodzhent
The head of the Track Department of the Railway is Mr I. N. Niyasov

The staff of the Chodzhent Permanent Way District consists of 363 person (370 planned)
Medium and smaller track works are done by own staff only predominantly manual (max. 40 % mechanisation, mechanisation means here small portable tamping machines), planned renewal works will be handled with a high proportion of manual work (change of rails and changed of damaged sleepers only

4.2.1.3 Standards and conditions of the infrastructure

The maintenance cycles (simple track maintenance, systematic track maintenance and renewal) are determined in the regulations of the former Soviet Union according to gross load of the track.

All railway administrations of this report have bought rails, points and wooden sleepers in Russia or the Ukraine. These materials have to be paid either in foreign currency or carried out as barter trade.

In this region, long-welded tracks mean that after 800 m three 12.5 m long track sections are laid with joints. If, because of the inadequate rail fastening, there are problems with the distance between the rail ends in the summer and winter seasons, enlarged or shortened rails are inserted in these three track panels.

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This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

4.2.1.3.1 Kazakstan

Due to the defective permanent way, about 3,000 km of the lines have speed restrictions, mainly 60 km/h, sometimes 40 km/h on about 16 % of the main tracks.

In 1996, 470 km of track were renewed, 770 km systematically maintained (renewing the defective parts of the permanent way), 400 km were simply maintained and deficiencies were corrected. Thereby, 1996 showed a slight increase. If the prolongation of the service life because of systematic track maintenance is calculated with 20 %, this means fictitious 620 km of renewed tracks - 3.3 % of the main tracks.

Rails:

At present, the following types of rails are inserted in the through tracks:

5 %	75 kg/m
80 %	65 kg/m
10 %	50 kg/m
5 %	43 kg/m

About 4,800 km of track are long-welded.

In the past, the condition of the rails and the admissible load limits had high priority. Thus, the rails were sufficiently renewed. This is why today large parts of the railway network are equipped with heavy rails. The consultants were told by RSE-Temirzhol that this year the purchase of rails was stopped. Since the reason for this seems to be the restructuring of the railway organisations, this stop will soon be terminated.

Sleepers:

At present, the following types of sleepers are laid:

30 %	concrete sleepers with bolts
70 %	wooden sleepers with spikes

An existing statistics on defective sleepers shows that only about 2 % of the concrete sleepers and 8 % of the wooden sleepers in the main tracks are defective. These indications correspond to the lengths of speed restrictions, based on the experiences from Module A of this project, however, the numbers should not be overestimated.

As regards the production of concrete sleepers, there are three concrete sleeper workshops. The concrete sleepers were produced only in the Russian system of ribbed sole plates. Since last year, the necessary fastenings have been produced in Kazakstan.

Points:

In the main tracks about 7,000 points are laid. Nearly 80 % are laid on R-65 type of rails, the remainder R-50. About 15 % of the points were found to be unsatisfactory.

Ballast:

In some parts of the country, in former times sand ballast beds were realised, the existing types of ballast are:

62 %	broken stone ballast
7 %	sand ballast bed
30 %	asbestos ballast
1 %	round ballast

The condition of the ballast bed mostly is unsatisfactory. The asbestos ballast was practically only used in North Kazakstan.

Structures:

In Kazakstan there are about 6,000 bridges. About 40 % thereof date from the time of the construction of the railway line, and thus are up to 100 years of age. Despite this, nearly no speed reductions are necessary, at present about 30 speed reductions result from of bridges. Far more often the foundation is underwashed. Most of the necessary works are done by railway staff. Major renewals of bridges could be done by local construction companies, however during the past years no money could be spared.

4.2.1.3.2 Kyrgyzstan

Because of the defective permanent way, about 60 km of the through tracks - about 15 % of the main tracks - have speed reductions to 40 km/h.

Rails:

At present, the following types of rails are inserted in the through tracks:

31 %	65 kg/m
60 %	50 kg/m
9 %	43 kg/m

About 30 km of the rails are long-welded.

Since the time of the breakdown of the former Soviet Union, only individual defective rails have been exchanged, never sections of rails.
There certainly is demand for renewal of rails, however local experts as well as the EU-experts do not think this is an urgent problem.

Sleepers:

At present, the following types of sleepers are inserted in the through tracks:

8 %	concrete sleepers with bolts
92 %	wooden sleepers with spikes

Since the time of the breakdown of the former Soviet Union, only individual defective sleepers have been exchanged, never sections of sleepers. Until recently, practically only

wooden sleepers were laid. Since money is scarce, too few sleepers were exchanged annually, which led to superannuated material during the past years.

Points:

Between 1990 and 1995, no points were exchanged. Only in 1996, for the first time 4 points were again exchanged.

Ballast:

In Kyrgyzstan, granite is won, broken and screened in a quarry. Thus, there is enough high-quality ballast.

State of Bridges:

Volume

The number of bridges is as follows:

-	bridges and tubes in total	844
-	thereof in Northern Kyrgyzstan	658
-	thereof in Southern Kyrgyzstan	186
-	bridges	167
-	thereof in Northern Kyrgyzstan	133
-	thereof in Southern Kyrgyzstan	34

Large Bridges

- a 207 m steel bridge crossing the Naryn River (Southern Kyrgyzstan)
- two steel bridges (66 and 34 m) on the section Bishkek - Rybatchye
- one 53 m arched concrete bridge on the section Lugovaya - Bishkek

There are no tunnels

Present state

In general, the state has been assessed by the railway authorities to be satisfactory. This holds especially true for steel constructions and pillars. Problems have been found as regards the abutment.

During the past years, damage to smaller brickwork bridges occurred (rents of different size and depth). In total, 29 bridges urgently need to be renewed. Some of these bridges were permanently inspected to recognise possible dangerous damage and necessary steps (such as limitation of speed or train weight, etc.) were taken.

According to the information given by the bridge and track departments there do not exist special speed restrictions caused by the state of the bridges, however, this is because the

maximum speed is everywhere comparatively low, just as the length and weight of freight trains. In case of future improvement of permanent way or increasing traffic volume bridges might remain a real bottleneck.

A special problem is the mountainous section Bystrovka - Kok-Majnak near the Issyk-Kul lake. Here the railway line is running along steep slopes and through deep cuttings strongly threatened by falling rocks, rubble and mud avalanches. Thus, this section requires permanent maintenance works. In the past, dangerous accidental situations took place (blocks of the track). In former Soviet times construction of an avalanche protection (*covered gallery*) has been started (financed by centralised funds). Finishing 250 m and beginning another 300 m of the planned 1.5 km only, the works had to be stopped after breakdown of the FSU railway system because of the lack of funds of the railways.

Maintenance and Renewal

The staff for bridge inspection and maintenance consists of 3 gangs with a total of 25 workers (two of them in the northern part of the network). An additional gang of 13 workers, partly working in shifts, is employed for inspection and clearing of the track-site from stones and rubble in the mentioned mountainous section.

Special bridge testing and measuring instruments, cars, etc. do not exist. Inspection is done as visual examination only. In former times regular measurement and testing has been done by the specialised central division of the MPS or by the Almaty Railways. Since the independence of the Kyrgyz Railways nothing further has been done. However, it seems not to be necessary to obtain own facilities. Taking into consideration the comparatively low number of large bridges, it is more useful to hire specialised teams from neighbouring railways within sufficient time intervals.

Apart from the staff responsible for inspection and small repair works the railways have an own bridge construction division employing a staff of about 200 persons. At present, this organisation is performing civil construction works inside the railways as well as for other clients only because of the lack of funds for financing bridge renewal works. The situation could aggravate, if the railways would not be able to keep a permanent bridge renewal schedule. Otherwise the special knowledge of this division would be lost, real private alternatives in Kyrgyzstan are obviously not existing at the moment. Taking into consideration the number of bridges to be maintained in the next years, a real demand for bridge construction works is obviously existing.

It can be summarised that the state of the bridges is not a main bottleneck in the works for the Kyrgyz Railways. However the speed of bridge renewal should be increased within the next years.

4.2.1.3.3 Uzbekistan

On 1.522 km of through tracks there are speed reductions - this means about 35 % of the through tracks. Speed reductions are ordered, if the scheduled maintenance period was exceeded.

In former times, 400 km of track were renewed. During the past years, this was reduced to 60 - 80 km per year.

Rails:

At present, the following types of rails are inserted in the through tracks:

76 %	65 kg/m
17 %	50 kg/m
7 %	43 kg/m

2643 km of the through tracks are long-welded. The track sections with long-welded rails show an accordingly good condition.

Recently Russian rails were compared with European and Japanese rails as regards price and quality. In future, it is expected that quality as well as prices will improve.

Sleepers:

At present, the following types of sleepers are inserted in through tracks:

70 %	concrete sleepers with bolts
30 %	wooden sleepers with spikes

The railway administration owns a sleeper factory which is 60 km outside of Tashkent. Here, pre-stressed concrete sleepers with ribbed sole plates are produced. During the current year, a tractor factory started the production of suitable mountings. Last year, 150,000 sleepers were produced, 50,000 thereof could be sold to Tadjikistan at a price of USD 15 each (without fastening). The theoretical production capacity is stated with 500,000 to 800,000 units per year.

If track panels were taken out of main tracks, these were dismantled and the sleepers were classified according to quality. About 60 % of the dismantled sleepers are qualified as being in such a good state that they may again be laid in main tracks.

Ballast:

Nearly the whole ballast bed consists of broken stones.

97 %	broken stone ballast
3 %	sand ballast bed

In case of track renewal, only the ballast of the electrified lines is cleaned, otherwise the track is lifted and filled with new ballast.

Points:

The renewal of points was of high importance also in the past years. In 1996, 249 points were exchanged. In Russia, roadway and fastening material costs USD 13,000.

Structures:

Many structures date from the time of the construction of the railway. This means that several steel bridges and pipe culverts are about 100 years old. Especially the pipe culverts were not calculated for such a long service life.

In the 60ies and 70ies, a type of steel bridges was used which then led to grave problems in the USSR. In 1985, this type of bridges was forbidden and it was strived for replacing the existing by new constructions. However, it was not possible to finish these renewals, and at present there is no money to do this.

Moreover, there are grave problems with the course of the rivers. On the one hand, the taking out of stones leads to a deepening of the bottom of the river, and therefore to an underwashing of the foundation. On the other hand, the intensified agriculture changes the river beds in such a way that the river changes its course in case of extreme floods. Then the masses of water cross the railway line in places without bridges. In this year, 2 embankment sections were swept away on a length of 4 km each.

The fly-overs of the drainage for agriculture today are partly undersized for the mass of water, which leads to suction effects and floods.

One of the largest structures is a bridge of about 1,000 m length over the Amudarya for the road and railway line towards Afghanistan which was newly constructed between 1981 - 1983, and thus is in good state.

Some bridges crossing the Syrdarya river are about 500 - 600 m long and date from the time of the construction of the railway line (1884). However, the rate of flow of the Syrdarya can be controlled, and thus problems arise only as regards the supporting structures, and not as regards the foundations and piers.

Minor maintenance works are done by the district inspector. For major maintenance works there is a bridge gang. New reinforced concrete girders can be produced by the construction group Mostostroy N° 7 having its headquarters in Tashkent or one of its branch offices. The resources being necessary for a new construction of large steel bridges are not available in the country.

4.2.1.3.4 Turkmenistan

Because of the defective permanent way, on 151 km of the through tracks there are speed reductions, which means only on 6.5 % of the main tracks. However, this does not at all mean that the remaining tracks show a satisfactory condition.

At present, the following types of rails are inserted in the through tracks:

1%	75 kg/m
80 %	65 kg/m
18 %	50 kg/m

1 %	43 kg/m

1,737 km are long-welded.

In 1995 and 1996, renewal of rails came down to practically zero.

Sleepers:

At present, the following types of sleepers are laid in through tracks:

82 %	concrete sleepers with bolts
18 %	wooden sleepers with spikes

Concrete sleepers are bought in the Ukraine at a price of USD 39 (excluding fastening material); the payment is not in cash, but by means of gas supply. A finished concrete sleeper workshop in Turkmenistan has an annual capacity of only about 10,000 units. An increase in capacity to 35,000 units per year is planned, but it is assumed that there is not enough money to buy the necessary raw materials (tension cable, etc.). The fastening parts are bought in Russia or the Ukraine.

Ballast:

There exists only 7 % sand ballast bed. The remaining 93 % are gravel ballast beds, which, however, are mostly heavily polluted by refined and small particles. New ballast is bought at a quarry being state-owned.

Points:

Since 1994 practically no points have been renewed. The points crossings are often in very bad state - worn-out.

Bridges:

The largest bridge of the country crosses the Amudarya river near Chardzhev. The condition as well as all problems are listed in Module C of this report.

Two bridges having each a length of 110 m were constructed in 1913. Their state is accordingly bad.

Some supporting structures with a bearing distance of 55 m also date from the time of the construction of the railway line. Moreover, there are numerous small bridges which are partly more than 100 years old. Turkmenistan has no structural engineers available for the calculation of such objects.

4.2.1.3.5 Tadjikistan

- Technical condition in the north much better than in the south (in Soviet times investments in the development of the connection to the Fergana valley), the eastern section from

Bekabad to Chodzhent has been doubled and equipped with comparatively new equipment in the 80-ies and 90-ies
- speed restrictions (in the north): about 21 km on a length of (because of the rails) in the east of Chodzhent with 50 km/h, 40 km/h on the station entries (because of the entry switch)
- in 1996, 65 km of R-65 rails were procured (most of them were not laid because of lack of funds for works and fastenings (no own production); in the past 2 years rails were changed in a total amount of 2 km only (mostly separate change of broken or worn-out rails)
- on the double-track section one track is long-welded
- in the north, 109 km of main tracks (about 64 %) have concrete sleepers with screw fastening, the rest are wooden sleepers with spikes, the present reserve of sleepers (in the north) amounts to approx. 5500 concrete sleepers and 3500 (new) wooden sleepers; in the south the track condition is partly very poor (wooden sleepers only, many of them damaged, light R-50, R-43 rails only)
- in the past 2 years 12,000 sleepers have been changed in the north (on the sections with wooden sleepers, only every 5th sleeper was changed)

At present, no track renewal at all is done.

- today, there is no own sleeper production and it is presently not planned to create one
- the ballast bed in the north consists nearly completely of gravel ballast, no own quarry does exist, ballast has to be imported from Uzbekistan
- the total amount of switches in the north is: 91 of R-65, 150 of R-50 and 48 of R-43
- switches are procured from Russia, but very irregularly, the demand for annual changing in the north has been estimated with about 20 switches, which means the demand is only covered by 50-60 %

Bridges

- in the north:
  Parts of the smaller bridges were newly built during the doubling of the track in the western section in the 80-ies and 90-ies, in total there are: 5 steel bridges (total length 218 m), 112 concrete bridges (1979 m) and 4 others (262 m), there are no large bridges, because the line is running on one side of the Syrdarya only, most of the bridges cross over dried-up river beds and melioration channels. Thus there are no major problems.

Tacis
This project is financed by the European Union's Tacis Programme, which provides grant finance for know-how to foster the development of market economies and democratic societies in the New Independent States and Mongolia

4.2.1.4 Track Maintenance Machines and Equipment

Amount / thereof in proper state

Railway Organisation	UK -25	ShOM-4	ELB	BMS	VPO -3000	VPR -1200	VPR -02	VPRS -500	VPRS -02	P -2000
Kazakstan Railway	68/8	13/9	26/7		32/16	26/21	26/20	21/5		10/9
Kyrgyzstan Railway					1/0					
Uzbekistan Railway	13/10	2/2		2/2	8/5		1/0			
Turkmenistan Railway	6/5	1/0	1/1	1/1	4/4					
Tadjikistan Railway		1/0								

The UK-25 is a so-called Platov crane for the laying or dismantling of track panels.
There are two different variants - the UK-25/9-18 and the UK-25/20. The laying capacity of the two types does not differ much and, in a manual, it is stated to amount to 750 m/h. Normally, the track is taken out by means of one crane, the second crane is used for track laying. For the laying of the panels, assister bars are used, which then are replaced by running rails. Moreover, special track panel transporting vehicles named USO as well as one motor vehicle named MPD are necessary. The track panel mounting location are always at the permanent way workshop for track machines, which leads to partly extreme long accesses to the construction sites.

ShOM-4 and SOM-4M are rail-bound ballast cleaning machines. First, the ballast at the end of the sleeper is excavated by means of a vertically mounted bucket wheel and transported to a rotating screen. Then, the track is lifted by means of an electromagnet and, by means of a plough, the ballast is pushed to a rotating conveyor belt or screen and cleaned. As last step, the ballast is profiled and compacted.

ELB is called an "Elektro-ballaster" and is a lifting and lining machine with ballast profiling device. This machine is used together with the Platov crane and the ShOM.

BMS is a rail-less ballast cleaning machine with integrated ballast regulator for the creation of the bearing surface for the sleepers and a compactor for the compacting of the ballast bed. This device is used between a Platov crane dismantling the track and a Platov crane laying the track.

VPO-3000 is a track lifting machine. It is used for the lifting of a track by means of an electromagnet. By means of a beam laying on the rails, the track is vibrated, however the sleepers are not tamped. The capacity is stated with 1,200 - 1,600 m/h in one working cycle.

VPR-1200 is a tamping machine with integrated lifting and lining device. Each time, 2 sleepers are tamped at the same time. The capacity is stated with 900 -1,200 m/h.

VPRS-500 is a tamping machine for track and points with integrated lifting and lining device. Only one sleeper is tamped at a time, the capacity is stated with 500 sleepers per hour.

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VPR-02 is a tamping machine with integrated lifting and lining device. 2 sleepers are tamped at the same time. This device was built in Russia under license of Plasser & Theurer.

VPRS-02 is like the VPR-02, however it is also suited for the tamping of points. As price, 1.25 billions of roubles were stated.

P-2000 is an electronic track recording car with integrated track lining device.

4.2.1.4.1 Kazakstan

The numbers of machines were investigated by the Kazgiprozheldortrans Institute at the railway administration in the consultants' name. The numbers were asked several times and always confirmed as being correct. Thus, there are high numbers of all types of permanent way machines. However, the condition of most of the machines is very poor, which leads to very long downtimes because of repairs, and some machines have to be classified as irreparable. This impression was confirmed during the visit of the track machine maintenance workshop.

4.2.1.4.2 Kyrgyzstan

There are no track laying or ballast cleaning machines.

The existing VPO-3000 lifting machine dating from 1970 is not in working order. The main reason for this is the lacking electromagnet which was stolen because of the high copper portion. There is no money for a substitute, however, given the age of the machine, the use of a repair seems doubtful.

One ShPM-02 can be used and is used. The ShPM-02 is a small tamping machine. Only one sleeper is tamped at a time. Given the small railway network, the tamping capacity of this machine is sufficient. Problems arise from the fact that this machine can neither lift nor level.

The permanent way workshop houses a snow plough which is also maintained. However, there is not much requirement to dispose of snow. Thus, this plough is mainly used for the removal of lost freight.

Moreover, there are two track motor cars equipped with cranes. The wrecking train is equipped with a crane wagon which can also be used for scheduled works. For the whole area, there are about 20 generators, some of which have to be steadily repaired. Each gang is equipped with hand tampers and track jacks.

There are no power wrench, rail cutters nor rail drills.

19 ballast wagons exist.

4.2.1.4.3 Uzbekistan

In general, each permanent way workshop for track machines is equipped with two Platov cranes and one track lifting device VPO-3000.

Most of the heavy permanent way machines are located in the permanent way workshop for track machines in Tashkent. Two Platov cranes are located in the workshop. Last year's capacity amounted to 20 km of track exchanges. The possible capacity is indicated with 100 km per year. Also the two ShOMs are located in this workshop. During the last year, 28 km of track were cleaned by means of these machines. By means of the two VPO-3000, last year 209 km of track were corrected and the ballast bed stabilised.

The only VPR-02 tamping machine of the country is situated at the district inspector in Tashkent. At present, it is being repaired. It is planned to tamp 20 km with this machine in the current year. During the first 5 months of the year, however only 2 km could be tamped. The procurement of the necessary spare parts was ordered by the general headquarters.

Each district inspector is equipped with small tools, such as rail drills, hand tampers, electric generators, rail saws which all seem to be in good state.

4.2.1.4.4 Turkmenistan

The existing heavy machines are practically only used for the construction of new lines. This holds especially true for the 5 useable Platov cranes, with which in total 84 km of track were laid in 1996.
The only existing ShOM is also used for the construction of new lines. The cleaning screen does not work. Thus, the ShOM is only used as regulator.

In 1996, in total 91 km of track were lined by means of the four existing VPO-3000. Thus, the average annual capacity of each machine amounted to 23 km.

The workshops are only badly equipped with small tools. During the inspection of the line, the tamping of rail joints in the main track by means of poles was observed.

4.2.1.4.5 Tadjikistan

The situation with heavy track machines is very poor: no Platov-cranes, no tamping machines, the park consists of 15 ballast cars only. In the south should exist one ballast cleaning machine (probable not working).

Major track works have been done by the centralised teams from Tashkent only in the past, in theory these machines could be hired, but the Tadjik railway has no funds to manage this.

4.2.1.5 Maintenance and repair facilities for permanent way machinery

4.2.1.5.1 Kazakstan

There are 28 permanent way workshops for track machines. These workshops house above all the heavy construction machines; mostly only minor repairs and service work can be executed.

In former times, Almaty had a factory for the production of individual heavy machines. Recently also major repairs, e.g. of Platov cranes and lining machines, were started. The workshop is equipped with relatively old metal working devices, however these are properly maintained. Major problems arise as regards spare parts which cannot be produced in this factory. According to RSE-Temirzhol it is planned to execute major repairs in Russia.
The repairs of the permanent way tools and devices are mostly done within the respective permanent way and structure district.

4.2.1.5.2 Kyrgyzstan

The permanent way workshop is situated in Bishkek, housing the few permanent way machines of the country. Since there is practically no money for spare parts, it is tried to maintain the machines by means of very simple methods. This results in downtimes of about 50 % e.g. for track motor cars, and on the other hand repairs are limited. The main problem constitutes the lack of money, and thus no spare parts can be bought.

4.2.1.5.3 Uzbekistan

Repairs of devices and machines are mostly done in the home depot. As regards repairs of motors, support is granted by the locomotive workshops. 3 years ago, a repair workshop for machines was founded in Bukhara, however there is no money for completion. No permanent way machines are sent for repair to this workshop from Tashkent.

4.2.1.5.4 Turkmenistan

Minor repair work is done in the respective workshop.

In Chardzhev, a repair workshop for permanent way machines dates from the time prior to the breakdown of the Soviet Union. In former times, this workshop was subordinated to the railway administration in Tashkent. The consultants had no time to visit this workshop. Since, according to the Turkmenistan Railway, the repairs of the machines are done in the respective workshops, it is assumed that the state of equipment of this workshop makes not possible to execute major repairs.

4.2.2 Recommendations for Improvement

4.2.2.1 General remarks

In general, as regards the recommendations it has to be said that due to the limited time for the execution of the study, in each country, only some tracks and permanent way workshops for track machines in the vicinity to the capital could be visited. Recommendations for improvement are stated for the country where deficiencies were recognised and/or discussed. Thus, some measures recommended to one railway administration may also apply in other regions. As regards Tadjikistan, no detailed recommendations for improvement were given, since, because of the political situation, this country could only be visited by the team leader for one day.

4.2.2.2 Organisational measures (recommendations)

4.2.2.2.1 Kazakstan

At present, the entire organisation at the level of the Ministry and the management of RSE-Temirzhol is being reorganised. This leads to a high amount of personnel turnover. In principle, disclosure of information is prohibited and has to be permitted by the management in writing on a project-to-project basis. Nevertheless, it was not possible until now to obtain data on the whole of Kazakstan from the RSE-Temirzhol management. Therefore, the reorganisation should be executed within a very short time. The operating length of the district offices amounts to an average of 960 km length of line. That of the permanent way shop to an average of 220 km length of line. Because of the already very large operating lengths, their number should not at all or hardly be reduced. If it can be succeeded in clearly increasing the portion of mechanised work, the average number of persons employed of 1.3 workers per km of main track could be further decreased.

4.2.2.2.2 Kyrgyzstan

Because of the small railway network, the one-level form of organisation (general headquarters = district office = permanent way shop) is very useful.

With 1.3 permanent way workers, the number of persons employed is very high considering the low traffic density of the lines.
If enough permanent way equipment, especially sleepers, is available, the creation of a mechanised gang for track renewal should be considered. This gang would have more know-how in the field or the renewal technology as well as in machine operation and maintenance.

4.2.2.2.3 Uzbekistan

The type of organisation and operating lengths of the district offices and permanent way shops was well selected. The existing special gangs for rail welding, bridge gangs, permanent way workshops for track machines, etc. prove to be a good system using the existing know-how.

The special situation of Uzbekistan the fact that the railways operate everything themselves, up to the ballast works and sleeper production. This results in a relatively high number of persons employed as compared to other countries. The disadvantage of this system is that no statistical cost accounting is possible regarding for example the manufacturing price of a concrete sleeper. This situation could be improved through the creation of independently acting units owned by the railway administration, but working economically independently (Profit Centres).

4.2.2.2.4 Turkmenistan

The number of persons employed has been reduced by about 25 % during the past years. The number to be reduced was not planned, but partly derived from the outward migration of the Kazaks and the Uzbeks. Partly because of the low salary being paid (USD 45 per month), today it is very difficult to recruit new workers.

Since there is one district office with only one permanent way shop, this permanent way shop could be administered by the neighbouring district office. Thus, the principle that each political district of the country disposes of a district office has to be thought over.

4.2.2.3 Recommendations for improvement of the permanent way and increase in quality of the track material

Maintenance cycles are clearly more often necessary as for example in Europe. This on the one hand because of the quality of the track material used and on the other hand because of the maintenance technology, especially as regards track machines.

4.2.2.3.1 Kazakstan

The 3.3 % of tracks having been exchanged during the last year suffice to keep the substance of the sections with traditionally high traffic. Due to the too low amount of renewals, the age structure has deteriorated especially between 1991 and 1995. This holds above all true for the lines with low traffic, which, however, today are part of transit routes. Especially the following lines have to be mentioned:

Aktogay	-	Almaty	557 km
Sajak	-	Mointy	338 km
Makat	-	Bejneu	300 km

Aktau - Bejneu 402 km (Module A of given project)

Not considering the line Aktau - Bejneu, since a feasibility study of this line was already subject of Module A, 1195 km of the transit lines are obsolete. Supposing that 50 % of the tracks will have to be exchanged, this results in the renewal of 600 km. Calculating this amount with the USD 313,000 for track renewal stated in Module A, this results in a necessary investment sum of USD 190 million.
This massive track renewal will be necessary, if the traffic on these lines will clearly increase. Also for these three lines a feasibility study will be required.

Only the section Almaty - Aktogay is on the TRACECA-route, the costs for this section would be about USD 87 million.

As regards the purchase of material abroad which has to be paid in foreign currency (above all rails), the price cannot be optimised by means of supply contracts with traditional trading partners, but by a skilful exploitation of the market. In addition, it will be necessary to check the quality, for which Russian test results may be used. The explanation that the Russian rails are preferred because of their high quality should be reconsidered. It would also be possible not to buy first-class quality rails, if the price will be appropriate.

As regards concrete sleepers, it should be checked whether to use alternative fastenings. It is recommended to use a kind of spring clips. Thereby, the necessary maintenance work could be reduced, which would be advantageous in the long run, and on the other hand the purchase price would be only slightly higher than that of the material used today. There are several system to choose from, however the clips without screws (as e.g. Pandrol clips) should be preferred, given the speed level in Kazakstan.

4.2.2.3.2 Kyrgyzstan

The most important problem constitutes the very old age of the sleepers. Since the Kyrgyzs have already recognised this problem, and the installation of the wooden sleepers from Russia used until now costs too much (USD 25 per unit), upon the initiative of the chief of Kyrgyz railways, Mr. Ablesov, the manufacture of concrete sleepers in a precasting plant in Bishkek was already started. At present, the sleepers are manufactured according to the Russian system using ribbed sole plates. The annual volume of output is limited to about 10,000 units. Nearly all fastenings for this system are manufactured at home.

A new type of fastening shall be tested during the next months. Presently, the use of Polish spring clips is planned. Since per sleeper a set of clips has to be bought for USD 15, alternatives are still searched for. Therefore, the director of the railways was sent by fax a design of Pandrol as well as Vossloh clips with the European recommended prices exclusive transportation costs.

Due to the backlog of demand, it is planned to increase the volume of output. In the next 5 years about 40,000 sleepers would be needed, after that, 20,000 units per year would be enough. While the 20,000 units per year could be financed by the country itself, for the

accumulated need a credit will be required.

The local permanent way experts plan to get control of the backlog of demand by exchanging about every fourth sleeper. EU-experts recommend to exchange the sleepers of whole sections. As regards the old track sections, it will have to be put up with speed reductions and labour-intensive maintenance works.

4.2.2.3.3 Uzbekistan

In future, speed reductions should not be prescribed automatically as soon as the maintenance cycles are exceeded. Instead, a speed reduction should only be introduced after having checked and classified the state of the track according to determined parameters, the most important parameters being the quality of the track bed and the fastness of the sleeper screws in the concrete sleepers.
It seems to be useful to sort out good and bad sleepers during track renewal by means of the Platov crane. On the main lines with loads of more than 10 million tons per year, no old sleepers should be laid. If on main lines exclusively new track material is used and on the secondary lines only reusable concrete sleepers, it will be possible to clearly prolong the future maintenance cycles on main lines.

Quality and price comparisons when purchasing rails will certainly lead to better terms of delivery. Also the type of fastening to the concrete sleepers should be considered in this regard. The EU-expert recommends to use a type of fastening which needs less maintenance, e.g. the Pandrol clip.

As regards the exchange on the obsolete track sections along the TRACECA-route, the presently calculated credit by the Asian Development Bank to the amount of USD 60 million seems to be adequate.

4.2.2.3.4 Turkmenistan

During the past years, the Turkmenistan Railway executed practically no renewal at all of the existing railway network. Track material was only bought for the construction of new lines. The ballast bed is in a terrible state. Since there are no electrified lines, it is not planned to clean the track, but only lift it an fill in new ballast. This method would be sufficient, however it is practically never done.

The points crossings are worn-out. Re-surfacing by welding was stopped, since even after the re-surfacing by welding, parts broke off. In this regard it will be necessary to recognise the technological deficiencies, to correct them and to continue the re-surfacing by welding of the points crossings.

The exchange of the deficient 151 km of track mean a financial requirement of about USD 45 million.

4.2.2.4 Necessary modernisation of track machines

As regards the maintenance of the machines, the greatest problem constitutes the procurement of spare parts. For the machines of Soviet production, there are still all spare parts available in Russia. Due to the lack of money, these spare parts can hardly be bought, but it is rather tried to repair the machines by improvising. Naturally, this leads to very long repair times.
This, in turn, is one of the reasons for the very low annual capacity of the existing machines.

4.2.2.4.1 Kazakstan

The maintenance of the existing machines is given top priority, which necessitates spare parts for the purchase of which there is not enough money. In a separate project, an exact calculation of the required foreign currency is to be elaborated, a first rough estimate states USD 2 million. This project shall divide the large number of existing machines into machines in working order which shall be further maintained and machines to be withdrawn which shall only serve as stock of spare parts. A first talk brought the following numbers of machines:

Platov cranes	20 units
Cleaning machines	9 units
Lining machines (ELB)	13 units
Lining machines (P-2000)	9 units
Tamping machines for plain track	40 units
Tamping machines for points	3 units

The procurement of new ballast cleaning machines was given second highest priority. Calculating that of the 18,000 km main track about every 20 years the ballast bed should be maintained, this results in about 10 required cleaning machines with an annual capacity of 100 km. Since the existing ShOMs can not at all reach this annual capacity, about 2 new cleaning machines will be required.

Moreover, the demand in track motor cars for transportation of material as well as staff and the demand in small tools for permanent way is stated. The representative of RSE-Temirzhol did not give the procurement of tamping machines any priority. According to the EU-experts, however, due to the very old age and the bad tamping quality of the existing machines, also new tamping machines will be needed.

4.2.2.4.2 Kyrgyzstan

Because of the small railway network, there is not much demand in machines.
As regards necessary machines, the Kyrgyzs name the repair of the lifting machine VPO-3000, a third track motor car equipped with a crane and later on possibly a Platov crane.

Because of the old age of the tow existing track motor cars, the purchase of a third track motor car with crane certainly is a useful investment.

Whether the repair of the 27-year old track lifting machine VPO-3000 seems to be useful is doubted, a suitable device for the network would be a Junior tamping machine with enforced lifting device. With this device, the maintenance as well as the renewal works could be done. The existing tamping machine ShPM-02 could then be used in the Southern part of the railway network.

According to the EU-experts, there are two possibilities as regards track renewal: either a Platov crane should be hired from the neighbouring countries for the duration of the renewal or the works should be done by means of a set of small devices. These devices could be a rail-road excavator and an excavator with ballast screen.

Moreover small tools as power wrench, rail cutters and rail drills will be needed. The respective number depends on the future type of fastening to the concrete sleepers.

At present, the Kyrgyzs do not have the money to buy or repair any of the above mentioned devices.

4.2.2.4.3 Uzbekistan

In the whole country of Uzbekistan there is only one tamping machine. Since the existing VPO-3000s certainly cannot tamp adequately, there is high need of new tamping machines. In addition to the purchase of a tamping machine planned to be bough by the credit of the Asian Development Bank, further 2 machines should be purchased. One of the machines should be located in the permanent way workshop for track machines in Tashkent, the other two should be used by the other four permanent way workshops for track machines in time-sharing.

4.2.2.4.4 Turkmenistan

The procurement of small tools is given top priority by the Turkmenis as well as EU-experts. A detailed list of necessary small tools was handed over. As a whole, this list is OK, however the numbers of the individual types of devices is too high - e.g. 1,500 hand tampers for 2,700 track workers. When calculating USD 50,000 per permanent way shop and USD 100,000 per permanent way workshop for track machines, USD 800,000 are urgently needed.

As track machines with second highest priority were named e.g. Platov cranes, tamping machines, track motor cars, etc. An investment into such devices seems only useful in connection with a long-term track renewal programme.

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4.2.2.5 Measures regarding permanent way workshops for repair of track machines

In all countries included in the report, one of the gravest problems constitutes the repair of the existing track machines. Partly the suitable repair workshops are lacking, in all cases the time for the procurement of spare parts is too long. Thus, the guarantee of the means for the purchase of the spare parts should get high priority. Often, the repair of the machines is done in the permanent way workshop where these machines are located. An improvement could be achieved by centralising the repair of machines. These central permanent way workshops for repair of track machines should also use existing resources as e.g. motor repair shops for locomotives and tyre lathes in car repair workshops which are presently being created in some countries with the help of the Japanese.
In future, in the permanent way workshops for track machines only minor maintenance as e.g. oil change and change of wearing parts should be done.

4.2.2.5.1 Kazakstan

The main workshop existing in Almaty or a similar workshop existing in Northern Kazakstan should be extended to a permanent way workshop for repair of track machines being responsible for the whole of Kazakstan. The personnel seems to be competent; the number of existing shops and metal working machines generally will be enough. In any case, compared to the dislocation of repairs to Russia it will be possible to save foreign currency.

4.2.2.5.2 Kyrgyzstan

At present, it is planned to move the permanent way workshop for track machines in Bishkek, which is justified with the fact that there is not enough space.

According to the EU-experts, this measure could be postponed, if it is succeeded in integrating the repair of the track machines in the car repair workshop. This car repair workshop is being constructed 15 km outside Bishkek, the shops and sidings being practically finished, the largest part of the mechanical equipment, however, is still missing. Until this day, only a lathe for the treatment of tyres has been bought.

4.2.2.5.3 Uzbekistan

Due to scarcity of time, the permanent way workshop for repairs of track machines being under construction in Bukhara could not be visited. However, the creation of a central location for the repair of track machines in Uzbekistan will be necessary. The best position as regards geography would be between Samarkand and Tashkent because of the short transportation times.

4.2.3 Final recommendations

In general, it has to be stated that the condition of the permanent way as well as track machines and bridges has decreased during the past years. The reason for this is that the railway administrations have to pay taxes, and on the other hand do not get any money for the maintenance of the infrastructure. Thus, it is up to the respective governments to define the required transportation quality of the railways and to finance the necessary infrastructure (European model of separation Commercial Division / Infrastructure). If this will not be done in the near future, the rail transport quality will further decrease in the years to come.
Since certainly not all financial requirements can be covered by Western credits, also the training of the personnel employed in track maintenance will have to get high priority. This might well lead to favourable results, since the personnel has good knowledge of track maintenance. Thus, the training programme may have a high level using only some focal points. Therefore it is recommended to hold the largest part of the training courses locally and to supplement them by excursions to Europe. The focal points should be: track material quality and price, considerations of profitability, machine maintenance, machine employment plan, inspections of technical conditions.

It is further recommended to organise (once a year) a Central Asian Information Forum for Infrastructure Maintenance for the middle management. Since there would be no communication problems as regards the language, in this forum an exchange of views and information could take place. As the four-week visit of the EU-expert showed, each country disposes of information and products that could be interesting to the neighbouring countries. It would be possible that the EU helps in organising a first meeting of this kind.

As regards the procurement of machines or devices, accompanying measures shall guarantee that the machines can be maintained for their services life. This could be achieved either by longer warranty periods or by periodical subsequent delivery of wearing parts included in the purchase price. In case of financing of such projects by European investors, it is recommended to guarantee the performance and quality by responsible European operators. In this case, it is not the machine, but the performance which should be financed.

4.2.3.1 Kazakstan

Above all, the procurement policy of the newly created RSE-Temirzhol has to be thought over. On the one hand, it has to be investigated what could be produced at home and on the other hand the price and quality of the material bought abroad in foreign currency has to be more investigated.

The new railway administration RSE-Temirzhol needs financial assistance according to the following list of priority:

First for the procurement of spare parts for the existing machines. The amount of needed means shall be calculated in a separate project, today it can be only estimated with USD 2 million.

Small tools to the amount of USD 50,000 for each permanent way shop and USD 100,000 for each permanent way workshop for track machines makes a total of USD 5.8 million.

For the procurement of 2 cleaning machines USD 6 million are estimated.

A track motor car at a price of USD 500,000 for each permanent way workshop for track machines makes a total of USD 14 million.

For the avoidance of the speed reductions on the TRACECA-route between Almaty and Aktogay an amount of investment of USD 87 million was estimated. For a detailed calculation of the amount needed, it will be necessary to undertake separate studies.

4.2.3.2 Kyrgyzstan

The most important problem constitutes the backlog of demand in replacement of sleepers. During the next 5 years, about 40,000 sleepers will have to be replaced annually. Since the railway administration cannot raise the funds needed, it will need a credit amounting to USD 5 million.
Moreover, in the course of such a project, measures for the quality assurance regarding the concrete sleepers should be investigated. This refers to the selection of the optimum fastening as well as to the quality of the concrete sleeper. Based on a first cost-benefit calculation of the EU-expert, the use of a Pandrol clip is considered.

Moreover, the purchase of devices for the insertion of sleepers amounting to between USD 300,000 (one rail-road excavator and small tools) and USD 1.5 million (including Junior tamping machine) would be useful and is strived for by the chief of railway.

4.2.3.3 Uzbekistan

In general, despite the many speed reductions, the main lines are in relatively good state.

First of all there are no adequate tamping machines. It is proposed to purchase three tamping machines. One of them is planned to be purchased out of a USD 60 million credit of the Asian Development Bank for the improvement of the TRACECA-route. Two other tamping machines necessitate a volume of investments of USD 3.5.

The present efforts for an optimisation of the track material purchases have to be continued. In case of track renewals on main lines, new and old concrete sleepers should not be mixed. New rules should be prepared for the introduction of speed reductions.

4.2.3.4 Turkmenistan

The existing railway lines in Turkmenistan still have a relatively good substance stemming from former times, however the ballast bed often is in bad condition. If the strategy of

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inserting new track material only in constructions of new lines will continue for a couple of years, this will lead to major problems in maintenance after about 5 years.

The railways need support according to the following list of priorities:

Technical assistance in re-surfacing of points by welding.

Small tools for all permanent ways hops and permanent way workshops for track machines amounting to a total of USD 800,000.

Moreover, excavators, track motor cars, etc. are needed to an amount of about USD 1.5 million per permanent way workshop for track machines, thus in total USD 4.5 million

There is a backlog of demand for about 300 km of tracks, the necessary sum is estimated to amount to USD 90 million.

4.2.3.5 Tadjikistan

The own organisation for track renewal has been created on the paper only, track machines are not available, the track renewal organisation is busy with civil engineering works only.

The permanent way districts have no own budgets for procurement, they only got the money for the salaries from Dushanbe

The Railway has created a so called Survival Programme which includes procurement of track machines (likely of Russian production) for 1997 or 1998 (financing is not clear at all)

Own calculation by the infrastructure expert was impossible because of the insufficient data.

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Annex 1.1

1.1 Maximum speed of rolling stock

type of rolling stock	state	maximum speed
goods wagons	loaded	90 km/h
	empty	100 km/h
refrigerator wagons	loaded / empty	120 km/h
passenger coaches		100 km/h - 160 km/h*)
locomotives		100 km/h, up to 15% more admitted

*) passenger coaches of the former German State Railway (Deutsche Reichsbahn)

Annex 1.3.1

1.3.1

TRACECA PROJECT CENTRAL ASIA

Modul B

2130 Examination of Current Tariff Structure

Questionnaire

Passenger

- Please provide listings of tariffs currently in force.
- On what basis are tariffs calculated? Please provide examples.
- Are costs for the individual tariff groups recorded separately and compared to the tariffs in force to determine the profit or losses incurred?
- Is the Railway free to set tariffs or are these set by the Government or Ministry? In the latter case to what extent is the Railway involved in the tariff setting process?
- What separate tariff groups exist? Long distance? Commuter? Special tariffs?
- For which groups do special tariffs exist? Pensioners? Schoolchildren? Students Veterans? Others?
- Please provide whatever cost information exists showing the profit and loss of the passenger services individually.

Freight

- Please provide listings of tariffs currently in force.
- Please provide examples of how tariffs are calculated.
- How many different tariffs exist? Are they established according to the nature of the product: e.g. Minerals, Agricultural products, Containers etc?
- Are tariffs negotiated for individual shipments on a one-time basis?
- Is the Railway free to set tariffs or are these set by the Government or Ministry? In the latter case to what extent is the Railway involved in the tariff setting process?
- Please provide whatever cost information exists showing the profit and loss of the freight services individually, and if possible for the individual tariff groups.
- Are revenues from freight services used to offset losses incurred in passenger services?
- Does the Railway transport some goods on directives from Government without being able to negotiate a tariff?
- Does the Railway charge special tariffs which were negotiated in the past and which are still in force although no longer covering the costs involved?

Other Services

- Please provide details of tariffs for other services which the Railway may provide apart from Passengers and Freight.

Annex 1.3.2

1.3.2 Tselinaya Railway - Kazakstan

Operating & Financial Results

Description	Unit of Measure	Actual 9 Months 1995	9 Months 1996 Forecast	9 Months 1996 Actual	9 Months 1996 % Actual vs Forecast	% 9 Mths '96 vs 9 Mths '95 Actual
Total Traffic Units	Mio. Unit/Km	50,680	51,460	47,377	92.07	93.48
Freight	Mio. Tonne/Km	47,414	48,200	43,987	91.26	92.77
Passengers	Mio. Pass/Km	3,266	3,260	3,390	103.99	103.80
Revenues fr. Transport	Mio. Tenge	15,778	19,440	16,809	86.47	106.53
Freight				15,801		
Passengers				1,008		
Operating Expenses	"	12,259	16,340	16,319	99.87	133.12
Freight				14,436		
Passengers				1,883		
Profit from Transport	Mio. Tenge	3,519	3,100	490	15.81	13.92
Of Which: Losses from						
Passenger Services	"	-429	-1,113	-875	78.62	203.96
Freight Operating Profit	"	3,948	1,987	1,365	68.70	34.57
Other Net Revenues	"	1,663	686	1,713	249.71	103.01
Total Profit	"	5,182	3,786	2,203	58.19	42.51
Unit Cost	Tiyn/Unit Km	241.89	317.53	344.45	108.48	142.40
Accounts Receivable		12,514	8,155			
Of which: Transport		5,601	5,084			
Accounts Payable		8,530	13,265			
Of which: Transport		1,484	2,247			

Comments

The Tselinaya Railway in Kazakstan was chosen for review in this section of the project as the Western Railway is the subject of Module A of this study and we were refused any financial documentation from Almatinskaya Railway. The information was obtained during a two day visit to the Railway headquarters in Akmola.

The information provided here permits a comparison of the first nine months of 1996 with the equivalent period for 1995.

The figures show a reduction in total traffic units in 1996 compared with 1995 although the passenger services show an increase of close to 4%. On the other hand total revenues are 6.5% higher. The reason for this increase in revenues could be the result of increased tariffs or a reflection of the inflation effect. Unfortunately a breakdown between passenger services and freight services for 1995 was not provided, so that a comparison of the revenues for the separate services is not possible. However a comparison of the total results shows that the passenger services are being run at a loss which is being covered from the freight services, and that this loss increased in 1996 over 1995 in spite of the increase in passenger units.

The figures further show a decrease in profits from the freight services, so that if this trend continues the freight services will in the near future no longer be able to cover the losses incurred from the passenger services. Moreover, as mentioned elsewhere in this report; from observations made by the consultant it is clear that expenditures for maintenance and repairs are insufficient to maintain the equipment at the required standard and little is being done to bring the passenger services into line with the level expected with regard to comfort and general customer services.

The conclusions to be drawn are that the Railway will need to increase its freight revenues and therefore a review of the tariffs in force will be necessary. It is clear that the passenger tariffs are inadequate and therefore support from the Government in the form of subsidies will be necessary to maintain these services, given that the present income levels in the countries of Central Asia are presently insufficient for individuals to support higher fares.

The introduction of a cost accounting system which will provide unit costs for the various services provided is a necessity in order to determine where competitive tariffs can be introduced to increase the volume of freight carried, and to increase tariffs to enhance revenues where the Railway has a competitive edge over the competition.

Annex 1.3.3

1.3.3 Kyrghystan Railways

Operating Results

Description	Units	8 Months 1996			Actual 8 Mth	% Variance
		Planned	Actual	% Variance	1995	1996/1995
Freight Operations						
Freight Traffic Volume	Mio. TKm	265	303.8	14.64	259.8	16.94
Freight Loaded	'000 Tonnes	535	748.1	39.83	528.9	41.44
Freight Offloaded	'000 Tonnes	1630	1948.6	19.55	1443.6	34.98
Revenue from Operations	'000 Som	47845	50313	5.16	36574	37.56
Revenue from Basic Services	'000 Som	15999	15580	-2.62	7262	114.54
Miscellaneous Revenue	'000 Som	2340	2840	21.37	7642	-62.84
Duties & Taxes	"	17600	18992	7.91	14164	34.09
Total Freight Revenues	"	83784	87725	4.70	65642	33.64
Freight Expenses	"	-	56544	-	-	-
Profit/Loss(-) fr Freight Operations	"	-	31181	-	-	-
Passenger Operations						
Volume of Passenger Traffic	Mio. PassK	58	59.8	3.10	60.8	-1.64
Revenue from Passenger Services	'000 Som	6344	6533	2.98	5062	29.06
Revenues from Reserved Ticket Servic	"	32600	34550	5.98	28826	19.86
Other Revenues	"	4175	4222	1.13	4994	-15.46
Total Passenger Revenues	"	43119	45305	5.07	38882	16.52
Passenger Service Expenses	"	-	76398	-	-	-
Profit/Loss(-) fr Pass. Operations	"	-	-31093	-	-	-
Total Transport Revenues	"	126903	133030	4.83	104524	27.27
Transport Expenses	"	123712	132942	7.46	90373	47.10
Transport Profits	"	3191	88	-97.24	14151	-99.38
Profits from Secondary Activities	"	3496	5952	70.25	3988	49.25
Other Income & Expenditures	"	1155	8364	624.16	7046	18.71
Miscellaneous Charges	"		12333		1124	997.24
Net Result		7842	26737	240.95	26309	1.63

Annex 1.3.4

1.3.4 Kyrghyzstan Railways

Operating Expenses (In '000 Som)

Cost Element	1st Half 1995 Actual	1st Half 1996 Forecast	1st Half 1996 Actual	Variance Actual vs Forecast	Variance 1996 vs 1995
Payroll	20,627	22,758	22,727	-31	2,100
Materials	10,613	12,867	13,552	685	2,939
Fuel	11,200	9,859	9,555	-304	-1,645
Energy	1,069	1,548	1,383	-165	314
Depreciation	859	16,115	17,047	932	16,188
Insurance	17,329	20,998	28,514	7,516	11,185
Other Expenses	6,221	6,864	6,772	-92	551
	67,918	91,009	99,550	8,541	31,632

Comments

The information contained in the above tables was obtained during the team visit to Bishkek. The data provided is essentially of an operational nature. Nonetheless, it does indicate an increase in freight volume and stability in the volume of passenger traffic.

In the absence of reliable inflation figures the comparison of the planned revenues and expenses for 1996 are probably more meaningful than a comparison against 1995 results. This comparison indicates that the Railway is just able to break even from its transport activities. The figures further indicate that the profit from freight services is almost exactly offset by losses in the passenger services, which means that the Railway is being burdened through this cross-subsidisation to an extent which is adversely affecting the opportunities available in the freight branch.

The breakdown of the operating expenses in Table 1.3- 4 indicates more realistic depreciation charges, an increase in insurance expenses but more economical use of fuel and energy.

As mentioned elsewhere in this report; the state of the rolling stock and the level of maintenance in the countries visited is below normal. Therefore the Railway in Kyrghystan under present conditions is likely to find it increasingly difficult to maintain a viable service unless relief in the form of subsidies for passenger services is forthcoming, so that the revenues earned from freight transport can be used to preserve the rolling stock in an acceptable condition.

Annex 1.3.5

1.3.5 Tadjikistan Railways

Operating Results

Description	Unit	1st Half Year 1996			1st Half Year 1995			Variance	% Variance
		Forecast	Actual	% Variance	Forecast	Actual	% Variance	Actual 96/95	Actual 96/95
Freight & Passengers Transported									
Freight Transported	'000T	260	268.1	3.12	405	425	4.94	-156.9	-36.92
Daily Average	"	1.43	1.47	3.12	2.23	2.34	4.94	-0.86	-36.92
Wagons Loaded		6,370	5,997	-5.86	8,769	7,622	-13.08	-1,625	-21.32
Daily Average		35	33	-5.86	48	42	-13.08	-9	-21.32
Wagons Unloaded		18,200	15,382	-15.48	23,514	26,632	13.26	-11,250	-42.24
Daily Average		100	85	-15.48	129	146	13.26	-62	-42.24
Net Freight Turnover	Mio.Tkm	895	895.8	0.09	1015	1113.4	9.69	-217.6	-19.54
Passenger Traffic	Mio.PassKm	44	38.8	-11.82	183	92.7	-49.34	-53.9	-58.14
Total Traffic	Mio. Units	939	934.6	-0.47	1198	1206.1	0.68	-271.5	-22.51
Financial Results									
Revenues from Freight Services	'000 Rouble	4,950,702	2,887,292	-41.68	146,692	149,213	1.72	2,738,079	1,835.01
Revenues from Passenger Services	"	467,900	200,067	-57.24	9,576	9,108	-4.89	190,959	2,096.61
Total Revenues fr. Transportation	"	5,418,602	3,087,359	-43.02	156,268	158,321	1.31	2,929,038	1,850.06
Revenues from Diverse Sources	"	149,330	111,971	-25.02	3,628	3,611	-0.47	108,360	3,000.83
Operating Expenses	"	5,159,999	2,834,660	-45.06	95,634	77,624	-18.83	2,757,036	3,551.78
Cost per Unit	Rouble	5.50	3.03	-44.81	0.08	0.06	-19.38	2.97	4,612.62
Cost of Secondary Activities	'000 Rouble	77,705	-296,921	-482.11	2,574	3,064	19.04	-299,985	-9,790.63
Profit from Transport Activities	"	258,603	252,599	-2.32	60,634	80,697	33.09	171,902	213.02
Profit from Secondary Activities	"	71,625	408,892	470.88	1,054	547	-48.10	408,345	74,651.74
Total Profit	"	330,228	661,491	100.31	61,688	81,244	31.70	580,247	714.20

Annex 1.3.6

1.3.6 Operating Results Adjusted for Inflation Effect

Description	Unit	1st Half Year 1996		1st Half Yr	Variance
		Actual	- Inflation	1995 Actual	1996 v.1995
Freight & Passengers Transported					
Freight Transported	'000T	268.10		425.00	-156.90
Daily Average	"	1.47		2.34	-0.86
Wagons Loaded		5,997		7,622	-1,625
Daily Average		33		42	-9
Wagons Unloaded		15,382		26,632	-11,250
Daily Average		85		146	-62
Net Freight Turnover	Mio.Tkm	895.80		1,113.40	-217.60
Passenger Traffic	Mio.PassKm	38.80		92.70	-53.90
Total Traffic	Mio. Units	934.60		1,206.10	-271.50
Financial Results					
Revenues from Freight Services	'000 Rouble	2,887,292	57,746	149,213	-91,467
Revenues from Passenger Services	"	200,067	4,001	9,108	-5,107
Total Revenues fr. Transportation	"	3,087,359	61,747	158,321	-96,574
Revenues from Diverse Sources	"	111,971	2,239	3,611	-1,372
Operating Expenses	"	2,834,660	56,693	77,624	-20,931
Cost per Unit	Rouble	3.0330	0.0607	0.0644	-0.0037
Cost of Secondary Activities	'000 Rouble	-296,921	-5,938	3,064	-9,002
Profit from Transport Activities	"	252,599	5,052	80,697	-75,645
Profit from Secondary Activities	"	408,892	8,178	547	7,631
Total Profit	"	661,491	13,230	81,244	-68,014

Comments

Table 1.3.5 shows the operating results for the first half of 1996 and comparative figures for 1995 as provided by the Railway.

The figures show a serious decline in both freight and passenger operations occasioned to a large extent by the political situation in the country.

The financial figures as presented are not meaningful due to the serious inflation which has taken place over the time period concerned. Therefore the 1996 figures have been revised downwards, using an inflation rate of 5000%, to a level more in line with the values of 1995 and presented in Table 1.3.6.

Although the inflation figure mentioned is very arbitrary, Table 1.3.6 does indicate how serious is the loss of revenues and therefore also the profits. Unfortunately the operating expenses are not split between freight and passenger traffic, so that it is not possible to demonstrate the cross-subsidisation effect. It can nonetheless be assumed that the freight services are subsidising the passenger traffic in line with the observations made in the other countries visited.

When reviewing the tariff system for this Railway the serious inflationary situation will have to be born in mind and the tariffs based on a hard currency, unless the situation improves. This is in fact already the practice with regard to international tariffs in the region. Alternatively the tariffs will need to be regularly increased based on a factor related to the currency level at the time the tariffs are set.

Annex 1.3.7

1.3.7 Turkmenistan Railways

Financial Statistics

Description	Units	1994	1995	1996 9 Months	1996 Projected
Revenues from Transport Activities	Mio Manat	988	7,321	92,956	123,941
Operating Expenses	"	519	4,070	42,129	56,172
Profit	"	469	3,251	50,827	67,769
Development Expenses	"	93	2,020	54,820	73,093
Taxes on Profits	"	69	979	2,075	2,767
Taxes on Property	"	4	18	519	692
Net Result	"	303	234	-6,587	-8,783

Comparison: 1996 vs.1995

Description	1995		1996 Projected		Variance in $
	Mio Manat	$'000	Mio Manat	$'000	1996 v.1995
Revenues from Transport Activities	7,321	40,672	123,941	35,412	-5,260
Operating Expenses	4,070	22,611	56,172	16,049	-6,562
Profit	3,251	18,061	67,769	19,363	1,302
Development Expenses	2,020	11,222	73,093	20,884	9,662
Taxes on Profits	979	5,439	2,767	790	-4,648
Taxes on Property	18	100	692	198	98
Net Result	234	1,300	-8,783	-2,509	-3,809

Comments

The information gathered in Turkmenistan was very sparse due to the reluctance to divulge financial information. Considerable effort was spent in trying to obtain the necessary data with very little success.

In order for the comparison of the figures provided to be meaningful, due to the serious inflation in the country, they were converted into Dollars at the average rates for the periods concerned. The rates used were 180 for 1995 and 3500 for 1996.

The figures show that the Railway makes a considerable operating profit. It is however not possible to ascertain the extent to which the freight revenues are subsidising the passenger services. It can be assumed however that the position is similar to that in the other countries visited. It should be noted that Turkmenistan has the lowest level of incomes of the countries visited, so that the travelling public is in an even more unfavourable position to support higher fares than its neighbours.

The figures provided show a high level of development expenses: The Railway has been investing considerable funds in the extension of its network in recent years. Nonetheless, the comments made with regard to maintenance and improvement in services offered mentioned with regard to the other Railways in the region apply here also. The overall impression from the figures obtained suggest that the tariffs in force are sufficient to provide revenue for new investments and could be used to improve the level of service.

Annex 1.3.8

1.3.8 Uzbekistan Railways

Financial Results 1995

Description	Passengers		Freight		Total	
	'000 Som	$'000	'000 Som	$'000	'000 Som	$'000
Revenues:	986,476	19,730	8,338,874	166,777	9,325,350	186,507
Expenses:	1,614,538	32,291	4,319,619	86,392	5,934,157	118,683
Profit/Loss(-)	-628,062	-12,561	4,019,255	80,385	3,391,193	67,824

Selected Departmental Costs

Description	Labour	Materials	Fuel	Energy	Administration Depreciation & Other	Total
Locomotives	178,470	111,014	985,570	173,499	381,004	1,829,557
Wagons and Carriages	228,862	103,690	71,853	15,085	759,854	1,179,344
Permanent Way, Tunnels & Bridges	133,450	42,867	12,472	7,976	592,877	0 789,642
Stations & Freight Yards	91,470	7,435	1,764	51,087	116,433	268,189
Passenger Stations	17,223	23,005	2,581	9,682	20,288	72,779
Communications	64,431	10,261	2,494	44,953	112,668	234,807
Total	713,906	298,272	1,076,734	302,282	1,983,124	4,374,318

Comments

In Uzbekistan no written financial information was provided as permission was not given to provide the data. The figures shown were therefore extracted from financial records by the consultant and refer to 1995 only. The equivalent Dollar values at the current rate were calculated by the consultant.

In spite of this reluctance to provide financial information, the administration of the Railway in Uzbekistan appeared to be more efficient and advanced than in the other countries visited. It was also apparent that the administration is more open to change. There was reference to the introduction of a market oriented accounting system and a review of the tariff system.

This may therefore be a suitable site to establish a new system of costing and tariff-setting which could be introduced in the other Railways of the region once it has been defined and tested.

As with the other Railways the passenger losses are being offset by profits from the freight sector here also.

From the figures obtained it would appear that Uzbekistan is in a more favourable position to make improvements than is the case in other countries. Moreover, if the Government were to relieve the Railway of the infrastructure costs and subsidise the passenger service losses, the Railway would be in a position to increase its operating profits by 60 %.

Annex 2.1

2.1 Study Visit Programme

Date	Subject: main contents	Lecturer(s)	Place
07.03.	Arrival of the Turkmen participants		Frankfurt-on-Main
08.03.	Arrival of the Kyrgyz, Tadjik and Uzbek participants		Frankfurt-on-Main
09.03.	**Opening of the study visit** Welcome, organisational questions, explanation of details of study tour programme	Mr Griffiths Mr Prescha (DE-Consult)	Frankfurt-on-Main
	Sightseeing, leisure time		Frankfurt-on-Main
10.03.	**Presentation of the new structure of the DB AG** Railway restructuring in Germany Organisational structure of the DB AG	Mr Funk (DB) PR Department	Frankfurt-on-Main head quarters of DB AG
	Passenger station management Organisation of passenger service Tasks of station management Supervision of transport quality in passenger traffic and service quality	Mr Pohl (DB) Station Manager Mr Tintz (DB) Head of Passenger Service centre	Frankfurt-on-Main Main Passenger Station
	Freight traffic organisation of DB AG Freight traffic technology, train systems in single wagon and block train traffic, freight traffic offers to the clients, creation of freight traffic schedules, consideration of international freight train planning (LIM) and its using for creation of domestic traffic schedules	Mr Hartkopf (DB) DB Cargo, Dept. for Production and Technology	Frankfurt-on-Main head quarters of DB AG
11.03	Arrival of the Kazak participants		Frankfurt-on-Main
	Combined Traffic on DB AG Visit of container terminal Organisation of combined traffic, process organisation and technology on terminals Journey to Mainz	Mr Bruksch (DB) Terminal Manager	Frankfurt-on-Main freight station Frankfurt East

Date	Subject: main contents	Lecturer(s)	Place
	Rolling stock allocation, distribution of empty freight wagons Supervision of train movement and rolling stock allocation, distribution of empty stock of freight cars, using of EDP for distribution, take-over of freight cars with neighbouring railways, principles of RIC and EUROP	Mr Grosch (DB) DB Cargo, Dept. for Production Supervision	Mainz head quarters of DB AG
12.03.	**Locomotive rostering and maintenance** Planning and organisation of locomotive rostering and maintenance processes, aspects of locomotive operation in border crossing trains	Mr Dr. Krittian (DB) Traction Division	Frankfurt-on-Main head quarters of DB AG
	Co-operation of EU railways Organisation of co-operation of EU railways (bilateral and multilateral), tasks and importance of international railway organisations with regard to the needs of the new independent railway administrations	Mr Dr. Ludwig (DB) Head of International Relation Department	Frankfurt-on-Main head quarters of DB AG
13.03.	**Marketing and sales organisation in freight traffic** Organisation of marketing and sales organisation in domestic and international freight traffic, co-operation and competition with other transport modes in freight traffic	Mr Dr. Friedrich (DB) DBCargo Head of International Relations and traffic Exchange Department	Frankfurt-on-Main head quarters of DB AG
	Problems of railway development in Europe an CIS states, Financing of infrastructure projects Approach and results of railway restructuring in Europe, discussion about approach and methods of transition of Eastern railways to market driven conditions, regulation of relations between the government and the railways, project management of infrastructure projects, possibilities and pre-conditions for financing of infrastructure projects, economic and financial feasibility as main criteria for decision making	Mr Kulke (DE-Consult) Regional Managing Director	Frankfurt-on-Main head quarters of DE-Consult

Date	Subject: main contents	Lecturer(s)	Place
14.03.	Journey to Munich by ICE train		
	Rolling Stock Maintenance for ICE Visit of the depot for high speed trains of ICE-type, advanced techniques and technology for rolling stock maintenance, operation of high speed trains in Germany	Staff of ICE depot (DB)	Munich
	System of single wagon carry and marshalling Visit of the main marshalling station Munich-North Organisation of single wagon traffic on DB AG, existing train systems, freight traffic scheduling, organisation of marshalling processes taking into account client's demand, observance of transit times and other quality criteria, technical equipment and EDP support on marshalling yards	Mr Scherübel (DB) Head of the marshalling yard	Munich
15.03.	Sightseeing, Journey from Munich to Vienna by EuroCity train		Munich
16.03	Leisure time		Bad Vöslau/ Vienna
17.03.	Official welcoming	Mr Matousek (ARE)	Bad Vöslau
	Presentation of the new structure of the Ö.B.B Basis and requirement for a new railway structure: EU Directive 91/440, Federal Railway Act 1992, etc. Tasks and objectives of the new organisation	Mr Dvorak (Ö.B.B.) Director human resource development	Bad Vöslau training centre
	Monitoring of train traffic The organisation of supervision of traffic operation Organisation, tasks and aims of operation control Position of operation control in the business unit Operation/Route Management Tasks, aims and distribution of competencies of operation control and regional district offices	Mr Schiffner (Ö.B.B.) Operation control expert	Bad Vöslau

Date	Subject: main contents	Lecturer(s)	Place
	Transport quality and performance indicators Supervision of transport performance and transport quality in passenger and freight traffic	Mr Kerschbaum (Ö.B.B.) Operation control expert	Bad Vöslau
	Construction management and operation planning Organisational structure, tasks and objectives, consequences on train traffic and timetable	Mr Steindl (Ö.B.B.) Expert for construction management and operation planning	
18.3.	**Freight wagon maintenance** Visit of freight wagon workshop Organisation of inspections dependent on time and kilometric performance Organisation of the repair of damaged wagons	Mr Anderwald (Ö.B.B.) Commercial manager of the workshop	Jedlersdorf workshop
	Maintenance of locomotives and EMUs Visit to the locomotive workshop Organisation of the individual steps of overhaul of EMUs overhaul depending on time of usage overhaul	Mr Künzl (Ö.B.B.) Workshop manager	Floridsdorf workshop
	Technical and commercial border handling in freight traffic Central Marshalling Yard Kledering (Vienna) Technical take-over inspection: Take-over of trains according to mutual trust inspection system Commercial border handling: of trains taken over according to mutual trust inspection system, customs clearance	Mr Popp (Ö.B.B.) Yard manager and experts	Central Marshalling Yard Vienna
19.03	**EDP system and tools in field of traction** locomotive rostering, shift planning, regional shift preparation, duty charts for locations, staff disposition, locomotive employment planning for 4 regions, provision of the location, internal cost allocation	Mr Salzer (Ö.B.B.) EDP expert	Bad Vöslau

Date	Subject: main contents	Lecturer(s)	Place
	Tasks and targets of the Central Clearing House B.C.C in international traffic	Mr Redl (Ö.B.B.) Accounting expert	Bad Vöslau
	Combined wagon load mode Definition, development, present position of combined traffic Technical aspects of combined wagon mode, containers, carrier wagons, chassis, structure gauge, terminals Distribution and price formation in combined load mode Sale of transport service (price formation, Intercontainer- Interfrigo distributive channel UIRR distribution (International Union of Combined Rail-Road Transport), self-marketing)	Mr Fernbach (Ö.B.B.) Combined traffic expert	Bad Vöslau
20.03.	Journey to Wels and Salzburg		Bad Vöslau
	Tasks of a freight logistics centre Visit of the logistics centre of the Ö.B.B	Mr Staber (Ö.B.B.) Manager of logistics centre	Wels Logistics centre
	Rolling road (Rollende Landstraße) Tasks of this special combined traffic system, advantages and disadvantages	Mr Kreuzhuber	freight traffic Cargo Wels
	Organisation of border crossing in passenger traffic Organisation of passport control and customs clearance of passengers, operational aspects of border crossing, Preparation of a transit abstract for RIV clearance	Mr Auer (Ö.B.B.) Expert for border handling	Salzburg
21.3	**Simulation of the remote control system (Brenner line)**	Mr Haßmann (for ARE) Operation expert	Siemens plant, Vienna

Date	Subject: main contents	Lecturer(s)	Place
	International Timetable Conferences Adaptation of the organisation of the international timetable process to the new EU-directives, Route allocation at the Ö.B.B. process consolidation within the co-ordination of the overall timetables based on composition of the profit centres Passenger and Freight Traffic, long-and short-distance operation, short-third-party use of route	Mr Haiden (Ö.B.B.) Timetable construction expert	General Directorate of Ö.B.B, Vienna
	Sight-seeing, leisure time		Vienna
22.03.	Journey from Vienna to Frankfurt-on-Main by EuroCity train		
	Leisure time		Frankfurt-on-Main
23.03 24.03	Departure of the Study visit participants to Central Asia		

Annex 3.1

3.1

Examples of supra-national plans for new constructions and extensions
initiated by

A)

The Economic and Social Council of the United Nations
Economic Commission for Europe (ECE)

B)

Pan-European Transport Conference

Excerpt of the

EUROPEAN AGREEMENT ON IMPORTANT INTERNATIONAL COMBINED TRANSPORT LINES AND RELATED INSTALLATIONS (AGTC)

(Economic Commission for Europe, ECE)

the contracting parties

desiring
to facilitate the international transport of goods

aware
of the expected increase in the international transport of goods as a consequence of growing international trade

conscious
of the adverse environmental consequences such developments might have

emphasising
the important role of combined transport to alleviate the burden on the European road network, particularly in trans-alpine traffic, and to mitigate environmental damages

convinced
that, in order to make international combined transport in Europe more efficient and attractive to customers, it is essential to establish a legal framework which lays down a co-ordinated plan for the development of combined transport services and the infrastructure necessary for their operation based on internationally agreed performance parameters and standards

have agreed as follows

Chapter I, general

definitions, designation of the network, technical characteristics of the network (see page 3), operational targets,

Chapter II, final provisions

signature, ratification and acceptance of approval, accession, entry into force, limits to the application of the agreement, settlement of disputes, reservations, amendment of the agreement, amendment of annexes, safeguard clause, denunciation, termination, notifications and communications by the depositary, authentic texts (the original of this agreement, of which the English, French, and Russian texts are equally authentic, shall be deposited with the Secretary General of the United Nations).

Excerpt of the

Technical characteristics of the network of lines of importance to international transport

The parameters are listed in the following table.

Infrastructure parameters for the network of lines of importance to international combined transport

	existing lines fulfilling the infrastructure requirements and lines that should be extended		new lines
	at present	target	target
1. number of tracks	-	2	2
2. vehicle gauge	-	UIC B*)	UIC C1*)
3. minimum distance between centres of tracks	-	4.0 m	4.2 m
4. minimum nominal speed	100 km/h	120 km/h	120 km/h
5. admissible load per axle			
wagons => 100 km/h	20.0 t	22.5 t	22.5 t
wagons => 120 km/h	20.0 t	20.0 t	20.0 t
6. maximum incline	-	-	12.5 mm/m
7. minimum usable length of tracks	600 m	750 m	750m

*) UIC = International Union of Railways

Excerpt of the

railway lines of importance to international combined transport

(The Economic and Social Council of the United Nations)

(Economic Commission for Europe)

from Austria via Turkey to China

Vienna >> Budapest >> Sofia >> **Istanbul >> Ankara** (Bindirma >> Anmara) **>> Kapiköy >>**

Razi (Iran) **>>**

the logic continuance

Iran
Razi >> Tehran >> Meshed >> Sarakhs >>

Turkmenistan

Tedzhen >> Turkmenbashi / Farad

Uzbekistan

>>Bukhara >> Samarkand >> (Dushanbe, **Tadjikistan**) >> Tashkent >>

Kazakstan

>> Arys >>(Bishkek, **Kyrgyzstan**), Aktyubinsk, >> Almaty >> Akmola, >> Druzhba >>

China

Conference of the European Transport Ministers (CEMT)

Pan-European Transport Conference

Excerpt of the

Minutes of the Meeting Held on the Level of the Managers
(Budapest, 1st February 1996)

On the basis of the priority corridors determined by the Second Pan-European Transport Conference (Crete, 14-16th March 1994), a multilateral memorandum of understanding has been initiated for the development of a railway transport corridor between Western Europe and Asia.

Memorandum of understanding on improving the railway transport corridor Austria > Slovenia > Croatia > Hungary > Ukraine > Russia > Kazakstan

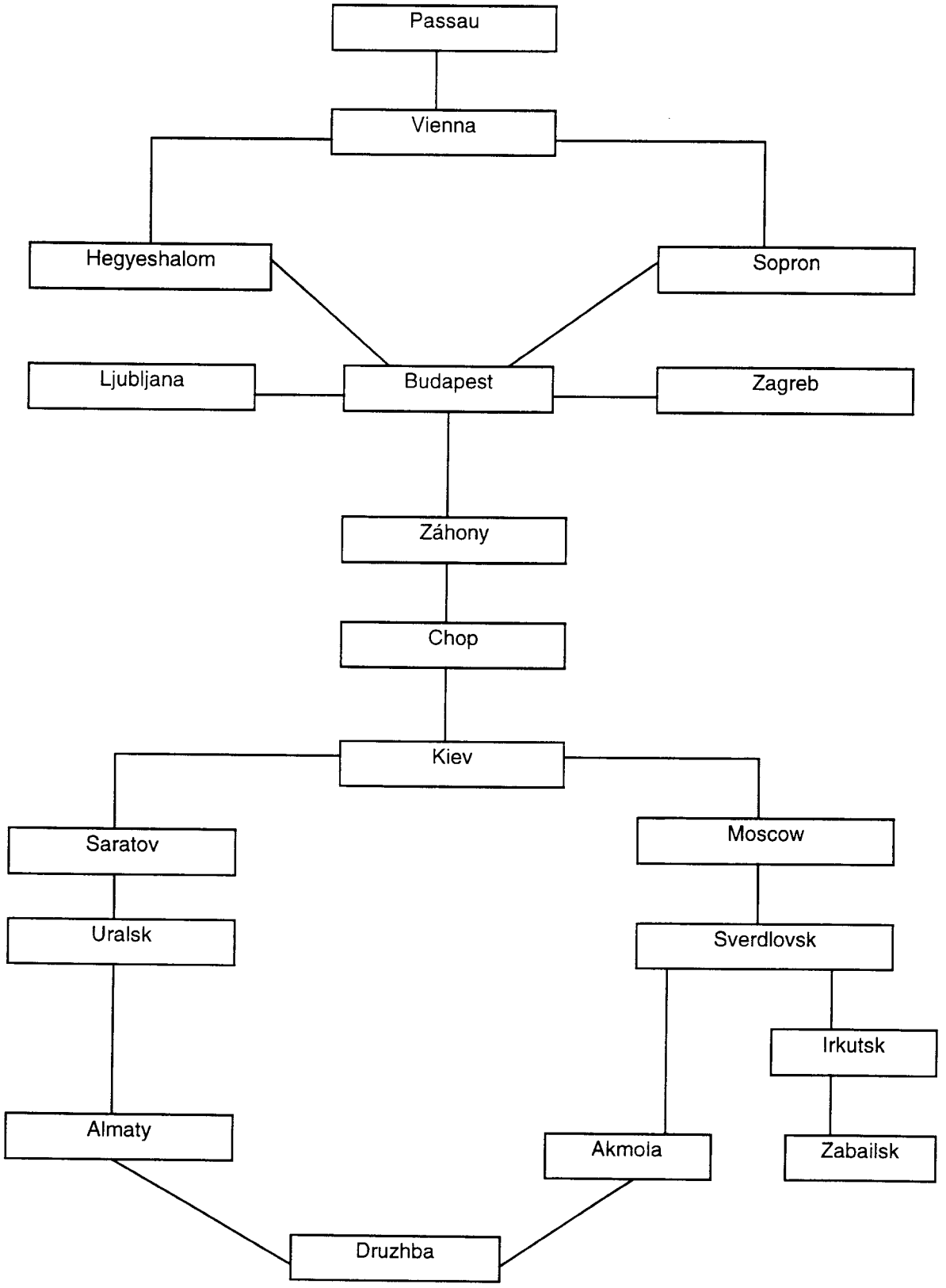
List of participants:

János Berényi, General Manager	GySEV	Györ-Sopron-Ebenfurti Vasut Részvénytársaság, Hungary
A. Moskovoj, Chief Economist	KZH	Almaty Railway, Kazakstan
R. Koller, Chef Expert	ÖBB	Öster. Bundesbahnen, Austria
Tomislav Mliaric, General Manager	HZ	Hrvatske Zeljeznice, Croatia
Zoltán Rigó, General Manager	MAV	Magyar Allamvasutak, Hungary
Bogdan Zgonc, Deputy General Manager	SZ	Slovenske Zeleznice, Slovenia
Leonid Zheliezniak, General Manager	UZ	Ukraine Railways, Ukraine

Giving priority to a better utilisation of the available railway capacities as well as to the development of medium-speed passenger and freight railway transport connecting Austria > Slovenia > Croatia > Hungary > Ukraine > Russia > Kazakstan,
Aiming at promoting the development of an efficient railway and combined transport between the aforesaid countries
Taking measures to ensure that railway transport should comply with environmental standards according to internal provisions of law in aforesaid countries and to international conventions binding the parties
Desiring continuous and efficient economic co-operation between railways
Regarding the bilateral and multilateral co-operation agreements in railway matters
Being convinced that the further development of the above-mentioned railway transport corridor is of regional as well as Eurasian interest

The ministers responsible for railways of Austria, Slovenia, Croatia, Hungary, Kazakstan, Russia and Ukraine, agreed as follows:

The ministers express their intentions to establish a trans-continental international railway traffic and to perform the necessary infrastructure improvements of railways making possible the operation of the railway transport corridor on a higher level between



Annex 3.2

3.2

Examples of potential block train relations and number of trains as well as days of train service

The general indications of the expected volume of traffic in the corridor Russia - Iran make only possible to give examples of a potential north-south transportation in block trains. The main goods stations "ARYS" (Kazakstan), "TASHKENT" (Uzbekistan) and "DUSAK" (Turkmenistan) were chosen at random.

- Arys because of the lack of detailed indications of the border crossings from Russia to Kazakstan and the goods flows in Kazakstan
- Tashkent and Dusak because of the lack of indications of the goods flows in Uzbekistan and Turkmenistan

As bases were used

- the forecast data until 2005 of the "state planning institute for techno-economic traffic research in the Ministry for Railways of the Russian Federation (MPS)"

  excerpt:

Exports to Iran	
	border crossing Tedzhen - Sarakhs
Countries	Tons per year
Russia	500 000
Turkmenistan	790 000
Kazakstan	590 000
Uzbekistan	550 000
Tadjikistan	120 000

- a net weight of 60 tons per wagon,
- 250 working days per year, and
- 50 wagons per train

Main goods station "ARYS"

Russia >> Iran

500,000 tons per year / 60 net tons per wagon = 8,333 wagons per year / 250 working days = **33 wagons per working day**

Kazakstan >> Iran

590,000 tons per year / 60 net tons per wagon = 9,833 wagons per year / 250 working days = **39 wagons per working day**

It can be expected that in **ARYS 72 wagons** per working day will be transported to Iran.

This means that 1 block train (with 50 wagons) can be transported per working day from ARYS to SARAKHS (Iran). The remaining 22 wagons can be transported with other trains to Tashkent in such a way that they will reach the block train from Tashkent to SARAKHS (Iran).

Main goods station "TASHKENT"

Kazakstan >> Iran

The remaining **22 wagons from Arys**

Uzbekistan >> Iran

550,000 tons per year / 60 net tons per wagon = 9,833 wagons per year / 250 working days = **37 wagons per working day**

Tadjikistan >> Iran

120,000 tons per year / 60 net tons per wagon = 2,000 wagons per year / 250 working days = **8 wagons per working day**

It can be expected that in **TASHKENT 67 wagons** per working day will be transported to Iran.
This means that 1 block train (with 50 wagons) can be transported per working day from TASHKENT to SARAKHS (Iran). The remaining 17 wagons can be transported with other trains to Tashkent in such a way that they will reach the block train from DUSAK towards SARAKHS (Iran).

Main goods station "DUSAK"

Uzbekistan >> Iran

The remaining **17 wagons from Tashkent**

Turkmenistan >> Iran

790,000 tons per year / 60 net tons per wagon = 13,167 wagons per year / 250 working days = **53 wagons per working day**

It can be expected that in **DUSAK 70 wagons** per working day will be transported to Iran.
This means that 1 block train (with 50 wagons) can be transported per working day from DUSAK to SARAKHS (Iran). The remaining 20 wagons can be transported with other trains to SARAKHS (Iran).

Benefits of an introduction of block trains:

- Reduction of shunting works in the transportation chain,
  from the main goods station on there will be no splitting up of trains or train formation.
  Reduction in transportation period
  Stops only for inspections of running order of wagons, change of locomotives and customs controls,
  shorter loading and unloading cycles, and thus better usage of vehicles,
  shorter stopping times for wagons in the network of a railway administration, and thus lower hire charges by the owning railway administration (if no wagon pools were created).

- Reduction in damage to freight and vehicles

These measures

a) improve the quality of the services,
b) increase the customers' acceptance of railway transportation
c) lead to higher competitiveness of the railways as compared to road transportation
d) influence the financial situation of the railways in a positive way.

Annex 3.3

3.3

Proposal

for the introduction of a quality management

by the example of the organisation form used at several European railway administrations and description of the tasks

Description of the tasks:

The quality management supports and improves the punctual, smooth and economic standard of operations, considering the aspects of customer service as well as the economic requirements based on the knowledge of the running of trains according to timetable, the situation of the infrastructure and planned or unforeseeable maintenance work.

Organisational chart see page 3

The individual offices for quality management are manned 24 hours a day. Within the business Unit Operation/Route Management the following offices are responsible for:

Traffic Operations

- prepares timetables for trains to be circulated at short notice
- carries out the resource planning in case of trains to be circulated at short notice or in case of cancellation of trains or shortage of personnel, locomotive or passenger coaches.
- informs the customers by means of TV or radio in case of delays of passenger trains

Central traffic control

- supervises the operation in the whole area of a railway administration in co-operation with the district control offices
- supervises the long-distance passenger trains and important goods trains connections
- informs neighbouring railway administrations about delayed trains
- arranges route deviations with neighbouring railway administrations
- agrees to the running of relief trains (in case of a high number of passengers), of extra trains (in case of a long delay of a train, in accordance with the responsible central control, an extra train will be circulated starting at a railway station to be determined instead of the delayed train), the addition of additional vehicles to the passenger trains (in case of a high number of passengers).
- agrees to the running of additional freight trains in accordance with the respective central controls and/or neighbouring railway administrations.
- informs the neighbouring railway administrations about cancellations of trains
- sets, in case of interruptions of service having consequences on sections outside the responsibility of the central control, the necessary measures for minimising such consequences.
- decides on stopping of passenger trains, decides on priority changes as well as the creation of connections, if these measures have consequences on the section of another central control.

Office for investigation of accidents

- collects records of the course and cause of an accident in train and shunting operation, informs the business units being affected by the consequences and cause
- analyses the course and cause of an accident in train and shunting operation
- gives proposals on how detected causes may be eliminated

Construction management planning

- collects the plans for the maintenance works during a timetable period which have consequences on train and shunting operations
- co-ordinates maintenance works, calculates the amount of consequences and provides the results for the preparation of an annual timetable
- agrees, after having examined the consequences, to excess in maintenance works as regards the time and/or place
- organises maintenance works to be done on short notice

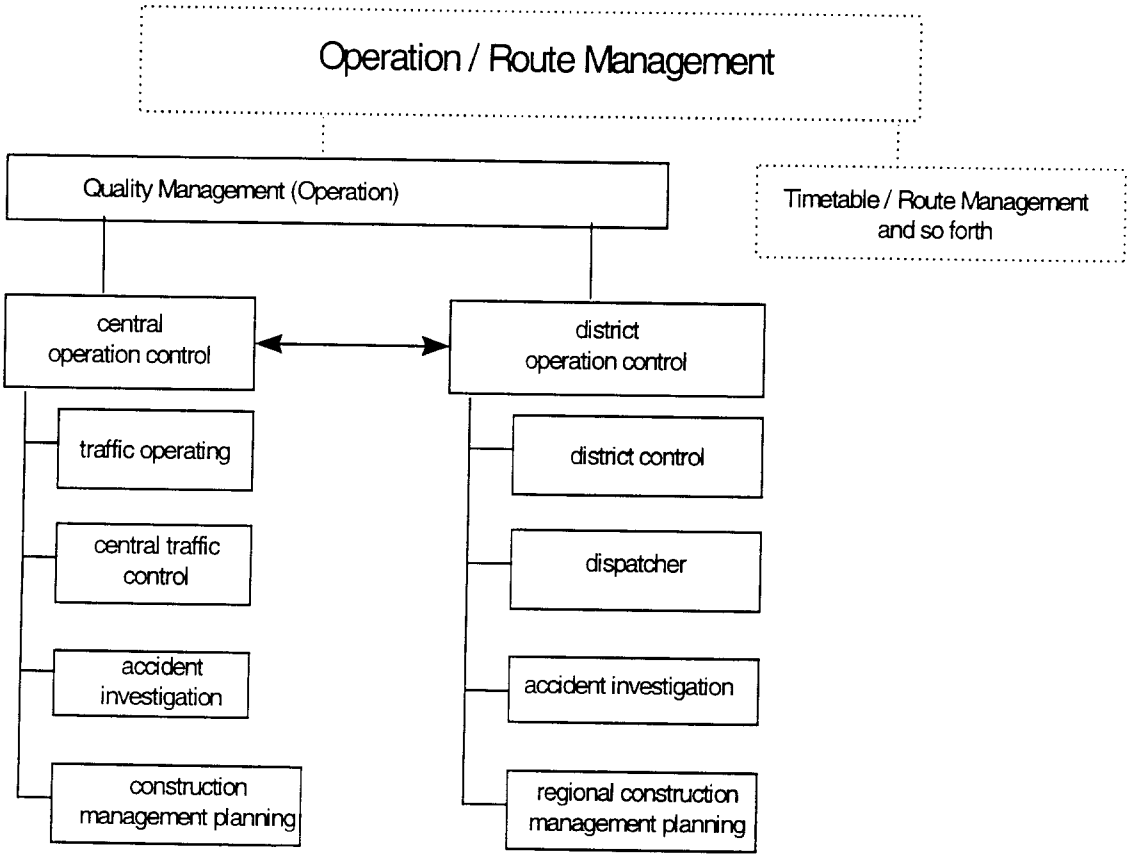
District control office

The district operation controls (at the Austrian Federal Railways (ÖBB) 4, at the Netherlands operating control BV 5) dispose of district control offices which guarantee a satisfying operation in their respective sections.

The district control offices

- submit to the central traffic control information on the situation in operation and all events affecting operation as well as on planned or set measures
- supervise operation in their sections
- inform the neighbouring district control offices about delayed trains
- arrange route deviations together with the neighbouring district control offices and in accordance with the central traffic control
- agree, for trains circulating only in their sections, to the running of relief trains (in case of a high number of passengers), of extra trains (in case of a long delay of a passenger train, an extra train will be circulated starting at a railway station to be determined instead of the delayed train), the addition of additional vehicles to passenger trains (in case of a high number of passengers).
- agree to the running of additional freight trains in accordance with the respective district control offices and the central traffic control
- inform the neighbouring district control offices and the central traffic control about cancellations of trains
- set, in case of interruptions of service, the necessary measures for minimising the consequences.
- give notice to stop passenger trains, decide on priority changes as well as the creation of connections, if these measures affect only the own section

All these offices are supported by telephonic advice or computer technology. In case of computer support, the necessary information is sent by the station signal boxes and line signal system and the roll-over control systems to the monitoring systems.
The monitoring systems are equipped with optimisation and simulation systems.



Annex 3.4

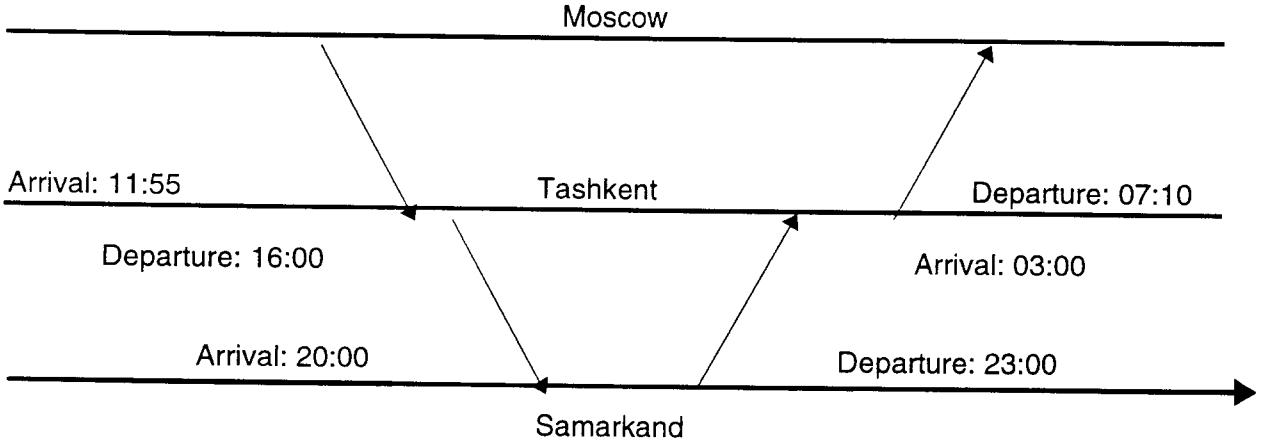
3.4

Proposal for an efficient employment of the rolling stock and the improvement of the economic efficiency of the pool of coaches

The degree of utilisation and thus the economic efficiency of the (own) coaches should be improved by additional offers.

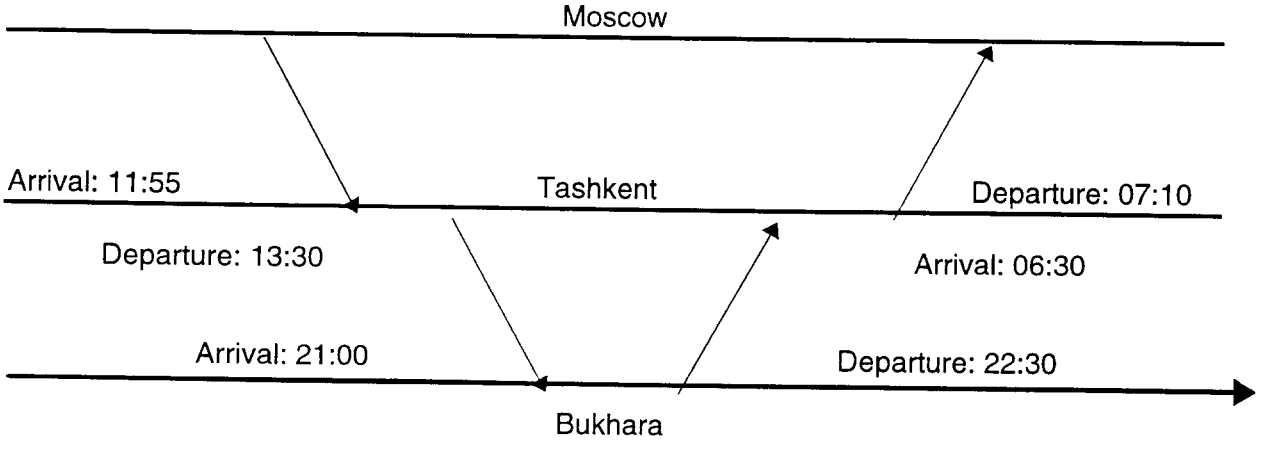
Example 1

Some coaches of the train 005/6 E, Moscow - Tashkent - Moscow, could be used for the day connection to Samarkand.



Example 2

Some coaches of the train 005/6 E, Moscow - Tashkent - Moscow, could be used for the day connection to Bukhara.



A prerequisite is that the trains circulate on schedule and the cleaning work and the investigations of the running qualities of coaches can be done in the time between arrival and departure of the train in Tashkent, Samarkand or Bukhara.

Annex 3.5

3.5

Proposal
for
the creation of Basic Interval Timetable (BIT) traffic

BIT-traffic means transportation services which are offered

- in long-haul traffic
  at least once a week and per day up to once an hour
- in local traffic
  daily from 15 minutes and less to once an hour

always at the same time and by means of connections and through carriages and the introduction of connection, feeder and distribution trains make possible a transportation offer covering the whole country (see page 3).

In principle, as regards long-haul traffic, the traditional train formations are used and for local traffic in general motor train sets.

Prerequisites for a customer-adjusted and economically justifiable creation of BIT-traffic are

1. an in-depth market research regarding long-haul and local traffic
2. an optimum physical (short distances at changing of trains) and timetable connection (short waiting times at changing of trains) to connecting trains and other carriers (airport, tram, underground or bus)
3. arrival times that correspond to the working hours of industry and trade or the opening hours of schools, authorities and trading companies

It is the aim of BIT-traffic

a) for long-haul traffic
   to connect state capitals, regional capitals, important industry, trade and commercial centres at national and international level. It is not necessary to realise these connections by means of through trains or carriages, also connections with changing of trains are possible.
b) for local traffic
   to connect towns surrounding state and regional capitals, industry, trade and commercial centres to one another and, within large cities industry, trade, commercial and school locations to the housing estates.

At the example of a line section, the possibility of an international BIT-traffic with connection and / or through carriages is presented.

Example 1 for the through service **Moscow - Tashkent**

Setting-up of a connection (train changing) or through coach possibility

in **Arys** towards **Almaty** and **Bishkek**
in **Tchu** towards **Akmola**
in **Tashkent** towards **Bukhara** and **Dushanbe**

Example 2 for the through service **Moscow - Almaty**

Setting-up of a connection (train changing) or through coach possibility

in **Arys** towards **Tashkent**
in **Lugovaya** towards **Bishkek**
in **Tchu** towards **Akmola**
in **Akmola** towards **Aktogay**

Example 3 for the through service **Moscow - Bishkek**

Setting-up of a connection (train changing) or through coach possibility

in **Arys** towards **Tashkent**
in **Lugovaya** towards **Almaty** and in **Tchu** towards **Akmola**
in **Tashkent** towards **Dushanbe, Bukhara**

Example 4 for the through service **Moscow - Dushanbe**

Setting-up of a connection (train changing) or through coach possibility

in **Arys** towards **Almaty** in **Tchu** towards **Akmola** and **Bishkek**
in **Tashkent** towards **Bukhara**

Thus, it will be possible to offer the connection Moscow Almaty, Bishkek, Dushanbe and Tashkent four times a week.

The consequent application of this method presents an optimum offer to the customers and improves the competitiveness. In general, the higher traction costs will be compensated for by an increase in the number of passengers. Costs savings can also be expected because of an improvement of the extent of utilisation of rolling stock.

Annex 3.6

3.6

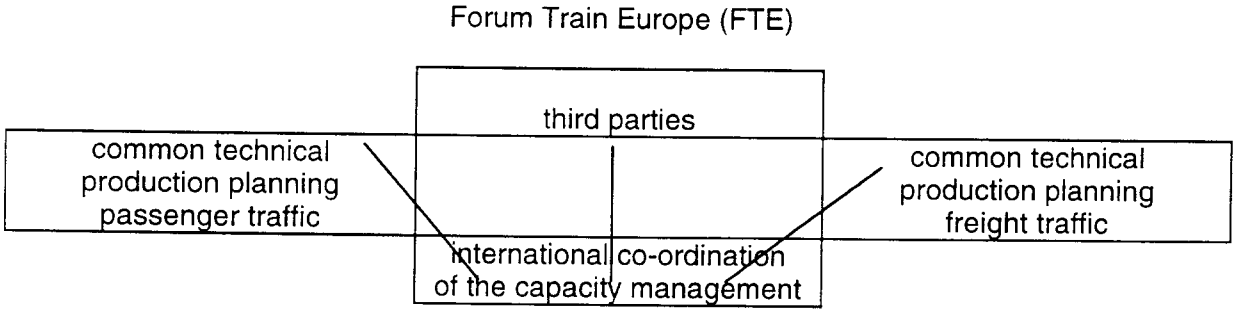
On the example of the organisational structure introduced at the European railway administrations, the

tasks, aims and time schedule for the co-ordination of the planning when preparing passenger and goods train timetables

are shown
and an introduction of this organisational structure in the Body for Harmonisation of Timetables with Neighbouring Countries (WMPS) is proposed

The marketing experts on passenger and freight traffic of the railway administrations and of third parties and the timetable experts of the railway administrations as well as bodies being responsible for route allocation harmonise within the framework of the "Forum Train Europe" (international co-ordination of the capacity management) all parameters for a homogeneous timetable (common technical production planning) within international passenger and freight traffic.

Organisational chart of the Forum Train Europe



Target and timetable of harmonisation works

Basic offers Basis: bilateral agreements, trains, train formation, through coaches, timetables, traffic periods	FTE 1 (June)	Basic offers Basis: bilateral agreements, train formation relations, timetables, number of trains, traffic periods, LIM-routes, demands for EUC connections
Strengthening of FTE 1	FTE 2 (July - September)	Strengthening of FTE 1, train parameters, train formation, co-ordination of national train paths with border-crossing traffic
Agreement on timetables, train formation, through coaches, connections, traffic periods	FTE 3 (October)	Agreement on timetables, train formation, EUC-connections, days of train service, determination of LIM-routes
Border handling harmonisation, E.W.P. conference (December), change of timetable	FTE 4 (December - February)	Border handling harmonisation, LIM-completion (April)

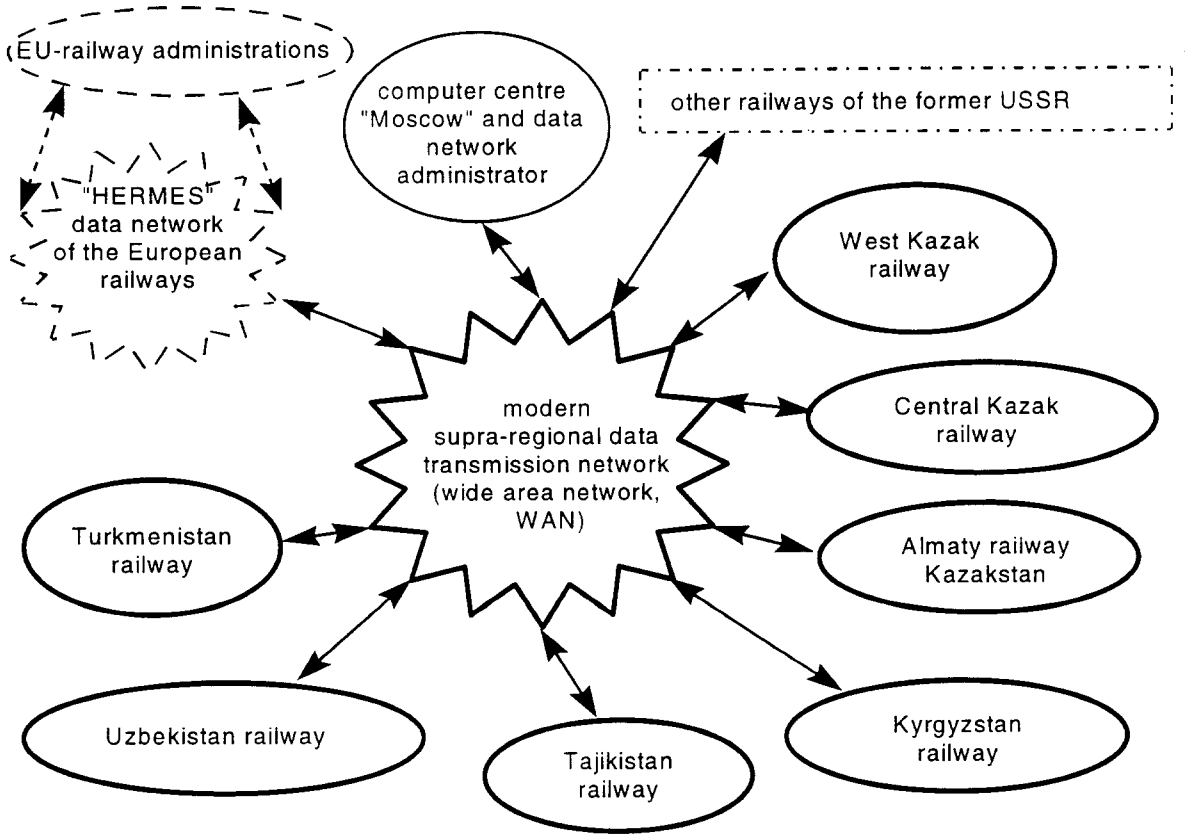
Legend:

FTE	**F**orum **T**rain **E**urope, all West European railway administrations are members, including the railway administrations of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Poland, Rumania, Slovenia, Slovakia, Czech Republic, Turkey, Yugoslavia
LIM	International Goods Train Timetable. The international transportation chains are made available to the interested railway administrations and customers in book form as well as on data carriers
Third parties	Provider of train services
EUC	**EU**ro-**C**argo, international goods trains connections which connect important industrial and trade centres with one another
E.W.P.	European through coach working plan - a plan with the results of the agreement on the number and types of coaches of international passenger trains, which railway administration prepares which routes, and which path a coach or a group of coaches shall take from the originating station to the terminal station and back to the owning railway administration.

Annex 3.7

3.7

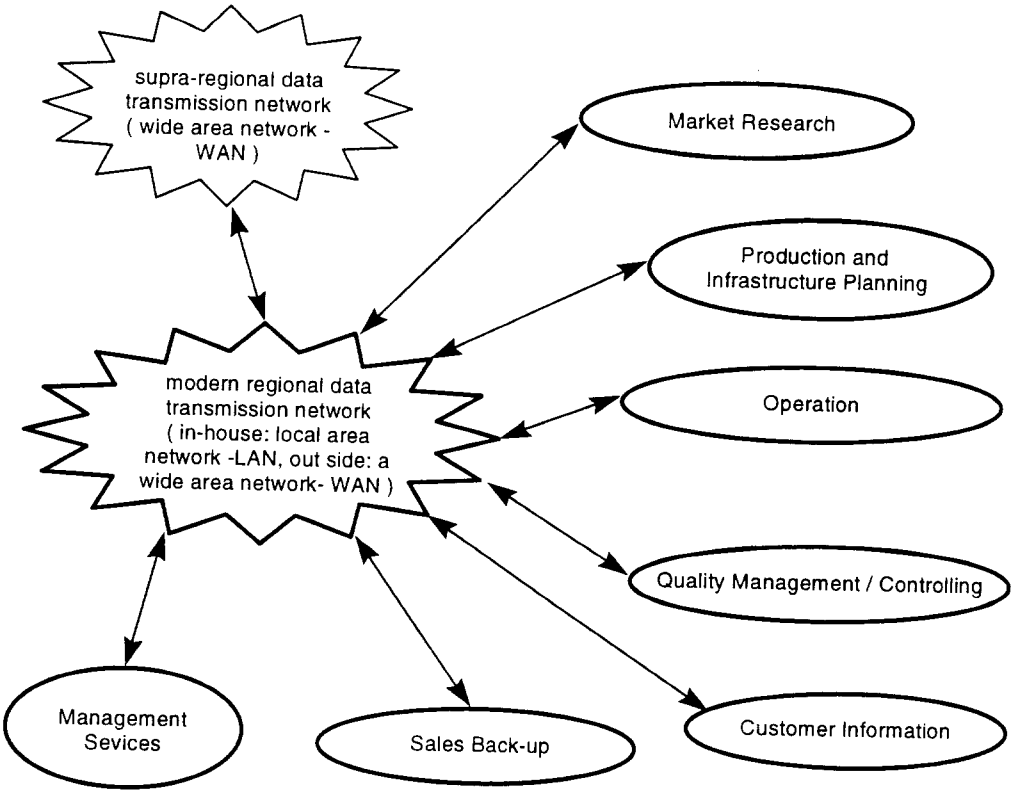
Possible structure of an international (interstate) data transmission network



Annex 3.8

3.8

Possible structure of an national data transmission network



Annex 3.9

3.9

Proposal for business areas to be supported by electronic data processing (EDP)

Market research:

The investigations may be acquired at low costs at external research institutes or experts who use methods and supporting systems that are state of the art and according to scientific knowledge.

Production and infrastructure planning:

A marketing concept based on a market research and a strategic business planning shall be established which determines the production methods and production systems. Supporting EDP-systems will be used for long-term planning (see page 4), medium-term planning (see pages 5+6) and short-term planning (see page 7).
The introduction of such systems shall be done in steps starting with the business unit "Timetable / Route Management" using a modular Route Management System, the core of which forms a route data base (see page 8). This data base forms the basis of planning of staff employment, planning of turn round of locomotives and passenger trains, transportation plans in freight traffic, customer information as well as operation systems.

Operation:

see Annex 4.1.4.1, Quality Management

Management Service:

Systems for

- salary accounting
- budgeting
- financial accounting

Quality Management / Controlling:

Systems for

- cost centre accounting, target performance comparison between planned costs and actual costs in all sections of the enterprise (see page 9).

Sales back-up:

Systems for

Passenger traffic

- ticket sale and reservation of seats
- accounting with the railways participating in the transport
- clearing of the transportation costs with the customers and check of revenues

Freight traffic

- clearing of the transportation costs with the customers and check of revenues
- replacement of consignment notes by electronic reports
- accounting with the railways participating in the transport

Customer information:

Systems for

Passenger traffic

- current transportation offer
- current transportation prices

Freight traffic

- current transportation offer
- current transportation prices

Annex 4.1

4.1 Line Staff for track maintenance and repair of the Kazak Railways

railway district, permanent way division		operating length				whole length			staff for track maintenance
[11] Subdivision	position of the office	total	of which I track	of which II tracks	of which III tracks	total	of which main track	of which yard	
1	2	3	4	5	6	7	8	9	10
former Tselinaya railway									
RD -1	**Kokshatav**								
PWD-1	Taintcha	183.7	183.7	-	-	261.3	183.7	77.6	211
PWD- 2	Kokshatav	312.0	214.0	98.0	-	620.0	411.0	209.0	502
PWD- 3	H. - Borovoje	190.0	-	190.0	-	541.0	381.2	159.8	438
PWD- 5	Novoishimskaya	264.0	8.0	256.0	-	706.0	521.0	185.0	572
Total on railway district - 1		994.7	405.7	544.0	-	2128.0	1496.9	631.4	1723
RD - 2	**Tselinograd**								
PWD- 4	Tselinograd	125.0	7.0	118.0	-	346.0	246.1	99.9	301
PWD- 6	Yermentau	305.0	270.0	35.0	-	471.0	344.6	126.4	410
PWD- 7	Zhaltyr	171.0	-	171.0	-	483.0	343.8	139.2	420
PWD- 8	Atbasar	118.0	-	118.0	-	308.0	217.7	90.3	268
PWD- 9	Yesil'	310.0	197.4	112.6	-	636.4	440.6	195.8	554
PWD-19	Sorokovaya	192.3	-	182.0	10.3	476	395.2	80.8	430
Total on railway district 2		1221.3	474.4	736.6	10.3	2720.4	1988.0	732.4	2383
RD - 3	**Kustanay**								
PWD-20	Kushmurun	160.2	-	160.2	-	494.0	321.0	173.0	401
PWD-21	Tobol	299.0	150.7	148.3	-	689.1	448.0	241.1	559
PWD-22	Kustanay	288.0	288.0	-	-	443.0	288.4	154.6	359
PWD-11	Novouritskoe	223.0	223.0	-	-	344.0	223.9	120.1	279
Total on railway district - 3		970.2	661.7	308.5	-	1970.1	1281.3	688.8	1598
RD - 4	**Pavlodar**								
PWD-17	Ekibastuz - 1	171.7	10.8	160.9	-	545.5	334.6	210.9	431
PWD-18	Pavlodar	171.4	-	171.4	-	567.1	346.9	220.2	448
PWD-27	Ekibastuz - 2	306.0	306.0	-	-	505.3	310.9	194.4	399
Total on railway district - 4		649.1	316.8	332.3	-	1617.9	992.4	625.5	1278
RD - 5	**Karaganda**								
PWD-12	Nurinskaya	109.0	-	109.0	-	300.0	218.0	82.0	249
PWD-13	Aschisu	245.1	245.1	-	-	333.0	245.1	87.9	277
PWD-14	Karaganda	140.7	114.5	26.0	-	225.3	166.5	58.8	187
PWD-15	Big Mikhailovka	141.4	-	141.4	-	385.5	282.8	102.7	320

railway district, permanent way division		operating length				whole length			staff for track maintenance
11			of which				of which		
Subdivision	position of the office	total	I track	II tracks	III tracks	total	main track	yard	
1	2	3	4	5	6	7	8	9	10
PWD-16	Agadyr'	183.0	-	183.0	-	501.0	366.0	135.0	416
PWD-24	Balkhash	372.9	339.4	33.5	-	553.0	406.4	146.6	459
PWD-25	Zhana-Arka	246.9	246.9	-	-	337.3	246.9	90.4	280
PWD-26	Dzhezkazgan	249.2	249.2	-	-	339.8	249.2	90.6	282
Total on railway district - 5		1688.2	1195.3	492.9	-	2974.9	2180.7	794.2	2470
Total on the former Tselinaya railway		5478.5	3053.9	2414.3	10.3	11411.6	7939.3	3472.3	9452
former West - Kazakstan Railway									
RD- 1	**Kzyl-Orda**								
PWD- 1	Chieli	217.0	97.2	119.8	-	417.8	340.7	77.1	332
PWD- 2	Kzyl-Orda	210.2	58.8	151.4	-	463.9	362.4	101.5	369
PWD- 3	Zhusaly	173.0	74.2	98.8	-	358.3	273.7	84.6	283
PWD- 4	Kazalinsk	183.3	2.8	180.5	-	503.8	367.0	136.8	401
Total on railway district 1		783.5	233.0	550.5	-	1743.8	1343.8	400.0	1385
RD - 2	**Aktyubinsk**								
PWD- 5	Chelkar	210.0	-	210.0	-	500.2	424.2	76.0	405
PWD- 6	Ber-Chogur	157.1	20.8	136.3	-	365.5	296.6	68.9	296
PWD- 7	Kandagatch	262.2	74.0	183.6	4.6	605.8	460.3	145.5	490
PWD- 8	Aktyubinsk	191.0	95.9	95.1	-	416.9	288.6	128.3	338
PWD-12	Shubar-Kul'	246.0	240.2	5.8	-	326.5	251.8	74.7	265
Total on railway district - 2		1066.3	430.9	630.8	4.6	2214.9	1721.5	493.4	1794
RD- 3	**Uralsk**								
PWD- 9	Iletsk	167.6	156.9	7.2	3.5	299.9	180.4	119.5	244
PWD-18	Kazakstan	165.0	165.0	-	-	225.6	165.0	60.6	183
PWD-10	Uralsk	165.0	165.0	-	-	301.2	165.0	136.2	242
Total on railway district - 3		497.6	486.9	7.2	3.5	826.7	510.4	316.3	669
RD - 4	**Atyrau**								
PWD-13	Atyrau	280.7	279.0	1.7	-	491.6	288.1	203.5	389
PWD-14	Ganushkino	303.3	303.3	-	-	391.8	303.3	88.5	309
PWD-15	Kulsary	220.0	220.	-	-	288.7	220.0	68.7	228
PWD-16	Mangyshlak	380.5	380.5	-	-	471.3	381.4	89.9	372
PWD-19	Bejneu	282.2	259,3	22,9	-	369,1	305,1	64,0	292
Total on railway district - 4		1466,7	1442,1	24,6	-	2012,5	1497,9	514,6	1590
Total on the former West-Kazakstan Railway		3814,1	2592,9	1213,1	8,1	6797,9	5073,6	1724,3	5438

former Almatinskaya Railway									
RD - 1	**Tchimkent**								
PWD-1	**Arys'**	126.1	42.4	83.7	-	393.9	211.0	182.9	293
PWD-2	Tchimkent	155.0	40.6	114.4	-	449.5	265.3	184.2	335
PWD-23	Turkestan	165.4	47.0	118.4	-	415.8	293.3	122.5	310
Total on railway district - 1		446.5	130.0	316.5	-	1259.2	769.6	489.6	938
RD - 2	**Dzhambul**								
PWD-3	Tulkubas	115.2	-	115.2	-	324.5	249.4	75.1	220
PWD-4	Dzhambul	322.5	209.5	113.0	-	696.6	436.6	260.0	472
PWD-5	Shu	222.5	10.0	200.8	11.7	644.9	435.1	209.8	437
PWD-6	Chiganak	264.0	71.0	193.0	-	513.8	456.2	57.6	348
PWD-7	Sary-Shagan	178.0	-	178.0	-	422.3	359.1	63.2	287
Total on railway district - 2		1102.2	290.5	800.0	11.7	2602.1	1936.4	665.7	1764
RD - 3	**Almaty**								
PWD-8	Chokpar	191.8	78.8	113.0	-	393.1	304.5	88.6	305
PWD-10	Almaty	214.0	158.8	55.2	-	560.9	271.0	289.9	436
PWD-12	Aina-Bulak	292.4	292.4	-	-	483.0	292.6	190.4	374
PWD-13	Matai	244.0	244.0	-	-	401.8	319.4	82.4	312
PWD-14	Beskol'	319.4	319.4	-	-	401.8	319.4	82.4	312
Total on railway district - 3		1261.6	1093.4	168.2	-	2189.2	1431.5	757.7	1698
RD - 4	**Semipalatinsk**								
PWD-15	Ayaguz	361.3	346.9	14.4	-	546.0	375.7	170.3	531
PWD-16	Zharma	169.0	157.5	11.5	-	238.7	180.5	58.2	232
PWD-17	Zhana-Semei	144.6	126.8	17.8	-	279.6	161.5	118.1	271
PWD-18	Semipalatinsk	126.3	0.7	122.7	2.9	441.4	255.6	185.8	429
Total on railway district - 4		801.2	631.9	166.4	2.9	1505.7	973.3	532.4	1630
RD - 5	**Zaschita**								
PWD-19	Shemonaikha	176.0	176.0	-	-	154.4	176.0	78.4	278
PWD-20	Zaschita	167.0	167.0	-	-	311.2	167.0	144.2	339
PWD-21	Serebraynka	172.0	172.0	-	-	238.0	172.0	66.0	260
Total on railway district - 5		515.0	515.0	-	-	803.6	515.0	288.6	877
Total on the former Almatinskaya Railway		4126.5	2660.8	1451.1	14.6	8360.0	5625.6	2734.4	6907

Annex 4.2

4.2

Summary

of the observed **weak points** and possible **solutions**

Existing Condition ***General Assessment***	**Recommendations for improvement** ***General Recommendations for Improvement***
Standards and Rules	
Introduction of new standards and rules	The existing standards and rules shall only be changed, amended or cancelled by mutual agreement of the OSShD railway administrations.
Network	
The state of repair of the track installations is very poor.	In the short term, given the actual staff situation, an improvement of the state of the track installations can be reached by a combination of mechanic and manual maintenance. In the long term, it has to be aimed at a reduction in import dependency regarding material, machines and spare parts.
It is urgently necessary to renew parts of the signalling, safety, telecommunications and EDP installations.	As regards the renewal of signalling, safety, telecommunications and EDP installations it has to be aimed at a reduction in import dependency regarding spare parts.
There are no concrete national and international agreements on the layout of the lines, the necessary technical standards of the lines and possible terms of realisation as regards the renewal and extension or reconstruction of lines.	In addition to the routes defined by TRACECA, renewal, extension and reconstruction plans have to be developed by the OSShD bodies, agreed within the framework of a conference of the transport ministers, and the works built on these plans have to be co-ordinated
Long-haul Traffic on the Corridors	
As regards parts of state territories that can only be reached via the territory of another state, construction of new lines are planned for avoiding long-haul traffic on the corridors and partly already under construction	The construction of new lines should not be done out of political reasons, but solely out of commercial and macro-economic considerations.

Rolling Stock	
The problems regarding the state of repair of rolling stock result from the lack of spare parts and the problematic procurement of spare parts abroad, the lack of suitably equipped workshops at the railway administrations or private enterprises.	A co-operation between the workshops existing at the railway administrations, but also with suitable private enterprises should be strengthened or introduced. In order to avoid surplus capacities and unnecessary multiple equipment, the modernisation of the machines or the installation of new workshops should be regulated in co-operation agreement.
EDP Information Systems	
The EDP concept and the employed hardware and software, the application software, the man-machine interfaces at the information system and the data banks as well as the data transmission technology do not correspond to the state of the art.	A restructuring of the central EDP concept into a decentralised concept according to the state of the art shall be introduced. When introducing national information systems, it should be paid attention to the compatibility of the data transmission protocols and the information to be transmitted.
Operation Methods	
Co-ordination and admission of journeys	
The dispatcher co-ordinates, supervises and admits the journeys in his section. An improvement of the reliability of the signalling and remote-control installations and the automatic train running control and radio communication with trains will be necessary for minimising the maintenance costs and improving the operational safety.	The type of co-ordination, supervision and admission of journeys is proven and also used at European railway administrations. As regards the necessary renewal and modernisation of the technical installations, a minor probability of failure and the availability of spare parts shall be considered.
Passenger Trains	
Taken the presently possible permissible line speed, no acceptable offer is possible.	Short term: increase of the permissible line speed to 110 km/h Medium term: increase of the speed to 160 km/h in selected relations and creation of BIT-traffic Long term: further increase of the permissible line speed
Freight Trains	
The presently used system is not suited for fulfilling the requirements of the economy and the customers	Increase of the speed of freight trains to 100 km/h, concentration of train formation in few, well equipped marshalling yards and check points, introduction of through trains in single wagon traffic.

Train configuration and shunting operations	
Passenger Trains	
The turnaround times of the sets of wagons in the train formation yards are too long	For an increase in efficiency of the rolling stock, it is to be aimed at a reduction of the standstills of a set of wagons or individual wagons thereof for being used in further train running.
Freight trains	
The existing train formation concept does not make possible to establish a transportation offer that meets the requirements of the economy or the customers.	Introduction of a new train formation concept for national and international (interstate) freight traffic
Operation control	
The existing dispatching does not constitute an efficient type of operation control	Introduction of a quality management system which guarantees the observance of the quality parameters in passenger and freight traffic agreed upon with the business unit Commercial Division and to grant an economic work procedure which corresponds to the aspects of customer service.
Timetable Planning	
There is no marketing concept comprising the national and international (interstate) traffic.	Introduction of a harmonised marketing concept as basis for the timetable planning.
International co-operation, co-ordination of freight and passenger timetables on each side of the border	
Passenger Traffic	
The body for the harmonisation of the train timetables with the neighbouring railway administrations (WMPS) does exist.	
Freight Traffic	
There is no body for the harmonisation of the train timetables with the neighbouring railway administrations (WMPS) for international (interstate) freight traffic.	Create a body for the harmonisation of the train timetables with the neighbouring railway administrations (WMPS) for international (interstate) freight traffic
The exchange of rolling stock including technical inspections	
Passenger and Freight Traffic	
The periods for handling at border stations are unacceptable for customers.	Simplification of customs and passport control, shift of the customs clearance to the train formation yards.