

TRACECA: Central Asian Railways

Restructuring

Module B: Uzbekistan

Final Report

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TRACECA

Central Asian Railways Restructuring

Module B: Uzbekistan

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0. Executive Summary - Business Plan

This document summarises the main conclusions and orientations of the project "Traceca - Central Asia Railways Restructuring – Module B: Uzbekistan" financed by the Tacis programme of the European Commission.

It is being submitted to the management of Uzbekistan Temir Yullari (UTY) and Uzbek authorities for review.

It will follow the following sequence:

0.1 Foreword

This mission was carried out in accordance with the provisions of the EU Tacis programme.

Lending to UTY would be subject to conditions on the economic usefulness of the project financed, on the presumed ability of UTY to reimburse the loan in the stated time frame, and on the potential overall impact the project financed would have in having UTY moving to more effective, more market oriented practices.

It is the Consultant's objective to identify and justify such projects so they could be financed by EBRD.

Three on-going processes did impact significantly the course of the mission:

- UTY's own expectations regarding electrification
- the resolute action of the Special Government Commission for Institutional Restructuring, since its creation in June 1997
- the similar process initiated by Asian Development Bank (ADB), whose consultants carried out similar analyses for a similar purpose

UTY strong focus on electrification did initially obscure the other objectives of the mission, and make data collection somewhat uneasy.

The action of the Government Commission did however provide clear indications of government expectations, available options, and priorities already decided on, which considerably helped cooperation with UTY and the Centre for Improvement of the Management Structure and the development of Regulatory Documentation (the Centre). This effective co-operation allowed a continuous exchange of views, and provided for anticipated validation of facts and recommendations.

The Terms of Reference did call for a balanced approach of the technical, economic and operational issues. Issues investigated by ADB did not have to be researched again, to the extent that facts and conclusions would be validated by all sides; conversely, as reflected in the inception report, it allows the Consultant to focus on issues where stakes are highest, or where more detailed analysis is relevant:

- the investment plan and its affordability, itself related to the future position of UTY in Uzbekistan
- the functional priorities in implementing the restructuring effort
- the performance improvements that should be expected from UTY in the near future

This document summarises conclusions about UTY, desirable objectives, and concrete recommendations; it provides a presumably sound basis for concrete business planning for UTY.

There are two main areas where technical assistance is recommended, to continue the momentum of this Restructuring Study. Firstly therer is a need to support the implementation of restructuring. Restructuring is a major change and there can be many difficult steps. There is a requirement for support for railway management through this complex process. It is likely that the first element of assistance would be over 18 to 24 months.

Secondly, the implementation of investment programmes brings new demands to the region in terms of skills in developing international specifications and procurement procedures. The IFI's usually also require Business Plans as part of the conditionality of the loan finance. Thus there is need for support for implementation of the investment programme. Details of this are given in 0.8 below.

There is good co-operation between the Railways of the Central Asian Republics and there is no reason to believe that this will change. A Regional Collaboration Conference, funded under the TRACECA programme, was held in Dulbin from the 31st March to the 4th April 1998. Senior representatives of the railways of Kazakhstan, Uzbekistan and Turkmenistan attended this. There was an extensive discussion on areas of possible regional co-operation. A protocol was signed on behalf of the participating railways which undertook to see how and when further regional collaboration could be further progressed, copy attached.

Many thanks are owed for its preparation to the many managers of UTY who have contributed their time and insights, to the four local experts contributing even more, and to the local members of the staff.

0.2 Conclusions on UTY's position and prospects

The reduced activity since 1989 does have three major consequences:

there is a need only for a substantially reduced number of employees to carry out the amount of
work actually needed; the process of reducing the headcount may take time, so as to
accommodate legitimate social concerns, but should not hinder the drive to improve operations
and efficiencies



- investment projects that did make economic sense with a higher traffic must be seriously
 reconsidered, as does the need to renew or expand the rolling stock fleet; this calls for a much
 reduced investment plan, that is in line with the reduced traffic, and is affordable on a smaller
 revenue base; this point has the single most important impact on the financial well being of
 UTY, and on the potential drain on public resources
- work practices related to operations and maintenance have become unsuitable to the current conditions, leading to excessive consumption of resources;

There is a particular concern for activities related to capital investment. The position of Tashkent as the management centre for the Central Asian railways endowed it with considerable technical expertise for most activities related to new investment in, or major repairs to the infrastructure. Though it is critical to retain in house the expertise to carry out these works, it may be detrimental to retain a capacity at a level too much above whatever works may be carried out in the future.

The investment bill submitted by UTY for consideration by the government of Uzbekistan and international lenders, in the amount of 2B\$, reproduced in ADB sponsored rehabilitation study ("investment requirements"), is plainly not affordable. The sheer magnitude of the bill reflects the above concerns. This issue is probably the single most important issue regarding UTY, deserving the most consideration from higher level, and lastingly so (cf institutional issues).

One such adverse consequence of excessive in house capacity may be an urge to keep investing in the infrastructure (at considerable cost), whereas the market may not warrant it, or the need to charge high prices for the services, that may be above world prices, and would not reflect the relative cost effectiveness of Uzbek labour today.

Traffic forecasts do not show any significant improvements in traffic volumes over the next ten years, that would justify postponing the downsizing effort.

The downsizing process is all the more important as threats do exist on higher value freight (manufactured products to be competed away by road transport, and oil products to be competed away by pipelines by 2004).

UTY's position is furthermore characterised by:

- weakened passenger services, cross subsidised by freight operations, that may further weaken freight services and therefore the entire company
- uncollectible claims on major customers (claims on UzNefteGaz, the largest customer, represent about one year of turnover)
- managerial practices relying on the routine application of standards, with insufficient costing and budgeting

0.2.1 Operating practices

Operations have become used to relying on excessive resources, for instance locomotives, leading to low utilisation rates.

Most loading and unloading is effected at a few locations, raising questions as to the relevance of keeping the less utilised ones within the railways (operation could be discontinued or transferred to the actual users of each facility).

Similarly, shunting operations are concentrated on a few oversized and under equipped shunting yards, while many others have little activity. Savings could be achieved by concentrating operations on a few shunting yards, to be partially automated¹.

Maintenance practices, which typically call for mandatory replacement of parts or of the complete unit after a given time has lapsed, were quite appropriate in older times (when the fleet was used intensively at Union level, and additions to the fleet were supposed to occur when utilisation rates became unacceptably high).

They prove to be less than ideal when utilisation is low.

Given the current priority of UTY on electrification, funds would not be available in the short term for this purpose; deferring investment on these issues would also avoid making toll many redundancies too quickly.



Work practices need to be adapted to the new conditions, and managers trained in applying them, and be given appropriate information and management tools; adapting work practices is probably needed before the headcount could be reduced if a further degradation of the service is to be avoided.

Many related software tools are used in the railway world (see MIS report and could be made available to UTY.

0.2.2 Competitiveness

The competitiveness of UTY has eroded compared with road transport, to a considerable extent for passenger transportation, and to a more limited one for freight transportation.

0.2.2.1 Passenger transport

For passenger transportation, the advantages of road transport in terms of speed, accessibility, frequency of service and price make it a formidable competitor²; railway transport is already profiling itself as a high cost, and presumably high service option. It is important to note that Uzbekistan has no duty to keep providing subsidised rail transport at regulated prices if cheaper road transport is available – and preferred –. Conversely, if rail transport is to be considered a luxury, it has to meet customers expectations, and cover its costs.

The contribution of this part of UTY to covering fixed costs has become so small, and prospects for sizeable improvements are so remote, that it must be considered for business purposes as a non profitable unit, to be supported by Government and local authorities and supplying services in accordance with their requirements.

This does not mean that service should be interrupted; rather, each and every service should strive for economic self sufficiency, or look for continuation of support from authorities.³ If social considerations would prevail; authorities would however carefully consider alternatives, i.e. road transport, before providing financial support.

The proposal to make passenger services semi autonomous within the railway organisation, to will provide for the needed transparency, and will give UTY the opportunity to try out new and more economical operating practices.

Today's regulated prices and forced cross subsidies are a form of support from the authorities, even if UTY has to pay for it



² E.g. bus service between Samarkand and Tashkent occurs every 15', at similar price, taking less time!

International services

International services have been largely discontinued, pending resolution of payment and technical matters. They can hardly be considered a strategic matter for UTY, as most of the traffic is carried out on foreign territory.

OECF has committed support to purchase high cost passenger carriages and related high price maintenance facilities, to be used on these international services.

The economic relevance of such services is highly dependant on the agreements to be passed with neighbouring countries through which the trains would transit; competitiveness is therefore not measurable at this stage.

Furthermore, marketing issues impacting on this competitiveness are still unsolved, as

- prices insensitive business customers would prefer using air transport for long distances
- even low prices are a deterrent to ordinary citizens victims of the economic depression
- a large share of the demand is believed to have come from "traders" smuggling consumer
 products between CIS countries; this demand would be negatively affected by strong action by
 Uzbek and other authorities (charges of up to 3%/kg are levied at Tashkent airport for
 transportation of foodstuffs; Kazakh railways have been considering charging for luggage)

It is therefore the opinion of the consultant that this investment has to be re-examined in the framework of the budget to be submitted by the passenger services company. It is assumed that such multi year budget would show the self sufficiency of the services, including the avility to repay for any loan contracted.

0.2.2.1.1 Intercity services

Intercity services are marginally profitable at this time, to the extent that rolling stock does not need to be renewed (profitable with low depreciation charges).

Business is being competed away by road transport and air transport. The ability to raise prices for regular services is therefore severely restricted. The challenge may therefore lie in providing superior services where rail can be competitive (overnight safe, reliable, comfortable, hassle free service, with superior on board service), and innovative (accommodation of tourists touring the historical landmarks of Uzbekistan and Central Asia). Tourists and business people are notoriously using very little rail transportation, preferring higher cost alternatives, that may not be more comfortable nor more effective.

Capacity utilisation rate is believed to be low, raising questions about either how to adapt the capacity to the demand (shorter or less frequent trains), or how to increase the fare collection rate.

0.2.2.1.2 Commuter services

Commuter services do cover only a small fraction of their costs; competing alternatives would come only from other subsidised public transportation systems (urban transport for suburbs). No specific assessment was carried out beyond measurement of costs / revenues.

0.2.2.2 Freight services

0.2.2.2.1 Domestic traffic

For freight transportation, the difference in prices between road and rail for domestic traffic (believed to be 1 to 4 or 5) should imply continuing competitiveness of the latter, and the presumed ability to raise prices without suffering a perceptible drop in demand.

For domestic traffic, the issue is therefore more regulatory that economic: does UTY actually need to increase prices, or should savings be achieved through more effective management, to be agreed on between the government and UTY.

There was however a shift to road traffic, that is likely to increase, particularly for short distances, or for sections that are much shorter using road transportation (e.g. south of Karshi).

As long however as most industrial customers will keep having their private sidings, the trend is likely to be moderate; customer choices seem therefore to be more related to quality of service than to price level (obligation of advance notice, delivery time, pre-payment, ...).

0.2.2.2.2 International traffic

For international traffic, Uzbekistan is dependant on OSZhD agreements, and is presumably⁴ a net importer of transit services; it may therefore not be in Uzbekistan's interest to see transit tariffs raised at the OSZhD conferences. In the future, Uzbekistan may become a transit country between the Far East and China and Western countries; this does however not impact the short term prospects of UTY.

Imports of consumer and other manufactured products has been increasingly carried out using trucks, typically from Turkey, Iran or Bulgaria. These trucks would go back home with any load, for instance cotton or other low or medium value commodities, thereby eating away at the railway traditional markets.

Competitiveness of rail transport is related to many factors, including tariff, but also speed, reliability, and ease of work with the transportation organisations. UTY is a minor link in the chain; its decisions concerning price and terminal operations do impact shippers decisions, but only to a limited extent. Extensive co-operation with other Traceca countries, and with Middle Eastern and Central European countries is needed for rail to gain back market share.

Statistics count as import / export the Uzbek traffic crossing Turkmen of Tadjik borders; transit traffic presumably includes intra Kyrghyzstan and intra Tadjikistan figures, which are likely to drop if effective cross border local economic integration is achieved



0.2.3 Economic equilibrium

0.2.3.1 Cost allocation

Cost allocation between the services can be a contentious matter. Though track and infrastructure do wear out more when there is more traffic (800M Tkm !), we will assume that track and infrastructure related costs are fixed costs to be allocated according to the presumed potential contribution of the services to cover them. Conversely, besides headquarters overhead, most costs can be allocated directly (traction, rolling stock, commercial staff).

On this basis, freight services do make a significant contribution, while passenger services do not.

We do make the hypothesis that the on going restructuring of passenger services will have them within one year contributing "only" 20% of revenue to covering the costs of infrastructure⁵. No further analysis will be made for passenger services.

0.2.3.2 Price level (freight)

Current price levels hardly cover the long term cost of maintaining and replacing the assets in their current definition; they may however be consistent with a reduced, more focused core network, and more effective operating and maintenance practices.

Prices are indexed on the old time rouble denominated price schedule, the index stands at 9000 at this time for most products, reduced by 33% for strategic commodities (mostly agricultural products), and increased by 150% for products that "can bear the increase", i.e. consumer products and oil products. They have hardly been revalued since two years, in spite of significant inflation and devaluation of the Sum.

Demand for most freight (excluding consumer products and general cargo, especially on short haul) is believed to be quite inelastic (significant price differential with competing road transport, and easy existing access of most customers to rail services). Moderate increases (5 to 20%) would therefore not impact significantly the level of demand, and are a political decision to make.

0.2.3.3 Price structure

The base tariff itself differentiates between commodities and distances. The built in price structure was based on detailed cost calculations ⁶that may be outdated; reforming it is however in itself a major undertaking, to be carried out with caution, and possibly only after detailed costing and management accounting systems have been operating for one to two years, and with a clear understanding of demand economics in Uzbekistan, to be gathered by a marketing department to be created.

⁶ Originally made by MPS



This is for the sale of simplicity of the analysis; effective pricing mechanisms between core railway and passenger services would rather be on a per train km or per carriage km basis, regardless of whether carriages are full or fares are collected

It is therefore more appropriate in the short term to reason exclusively on the price index that takes the base tariff as a given.

There will however be a need to define a price for inter-company or inter-division services within UTY (primarily prices for use of the infrastructure, and for traction).

0.2.3.4 Uncollectible claims

Even at current moderate, regulated price levels, UTY is unable to collect the revenue from the traffic carried out. Major state customers enjoy deferred payment privileges, which in practice allow them to defer payment till they are able and willing to effect it.

As a result, 12B Sum are owed to UTY (as of 12/97), which in turn defaults on 5B Sum of its own obligations; the net amount, 7B Sum, is slightly less than 100M\$ at official exchange rate, and represents a quite significant share of UTY's borrowing capacity (estimated in the order of 300 M\$).

This casts doubt on the presumed ability of UTY to repay loans that may be extended (will future claims be collectible, is the size of the solvent market as high as estimated?).

Resolution of related issues at the Cabinet of Ministers was said to be pending, possibly in the form of a decision regarding the status of current arrears. Decisions allowing a future arm's length relationship between UTY and its customers are a separate matter.

Decisions regarding the ability to refuse service to slow payers would enhance the financial credibility of UTY.

0.2.3.5 Cross subsidies

Freight traffic does at this time subsidise passenger services, in a less than transparent way that does not foster improvements in efficiency on either side.

The scheduled re-organisation of the passenger services would provide for such transparency and accountability, particularly if the organisation is further based on the operation of individual profit centres.

Re-organisation will however be most effective if it is accompanied with a more far reaching divisionalisation, and the implementation of management processes that would make it work.

0.2.4 Managerial practices

This area has been abundantly described by the ADB report: costing and budgeting systems are generally absent or unutilised, and the use of assets is typically undervalued, leading to insufficient funds made available to the upkeep of the infrastructure.

Most importantly, maintenance practices, for rolling stock, but most importantly for fixed installations, are based on periodic replacement (see above). This precludes the implementation of more complicated policies, which would require the use of information systems, but leads either to high maintenance costs (if standards are applied), or to less than operational infrastructure (if severe cash constraints do limit spending below what standards would prescribe).

Both areas are perceived as being an absolute priority.

0.3 General recommendations

0.3.1 Target for UTY - mission statement

The future UTY may be defined in terms of geographical extension, major technical choices, namely mode of traction and track design, and scope of services. The target may be summarised in a generic way in a tentative mission statement:

"UTY's mission is to deliver rail transport services meeting the needs of Uzbekistan in the most cost effective way, and to the extent that the economic and social value of the services exceeds their cost; it will also maintain the infrastructure in a dequatecondition and operate the said infrastructure so that traffic required by the market can flow freely and safely on the network"

0.3.1.1 Geographical extension

There is notable traffic only in the triangle Tchengeldy Bukhara Andijan (further labelled the "core triangle"), possibly extended to Karchi. To the exception of the Ferghana valley (accessible only through northern Tadjikistan), this represent the connex network of Central Uzbekistan.

The most immediately relevant section is the triangle Tchengeldy Khavast Navoi, where current and forecasted traffics make electrification a profitable proposition beyond any reasonable doubt..

The core triangle deserves continuing investment in track and facilities, including electrification, and a track that can operate at rated speed (80 to 120 km/h). Its size and connexity would allow an effective management of the fleet of electric locomotives. This does not mean that the infrastructure needs to be replaced, but rather that it needs to be maintained.

Extensions to Karchi and its region may not justify electrification in the near future, because of insufficient volumes.

Further developing the western and the southern networks or even further maintaining them to rated speed and capacity is not warranted by the current economic situation. Other rationales may prevail (regional development of the Central Western region – Utch Kuduk, and security of the Afghan border), that are related to issues of national interest, and which could possibly justify the government to order specific actions to UTY, which may not be in its economic self interest, nor in the interest of its customers.



Secondary lines, primarily Navoi – Utch Kuduk, are run for the benefit of a handful of customers, mines, key industries and their communities, with a low traffic level. Handing them over to these customers would allow UTY to concentrate on operating the core network more efficiently. The principle is already applied *successfully* in Uzbekistan; Almalyk is believed to operate a 320km network, connected to UTY network.

0.3.1.2 Mode of traction

Traction can be effected using electric locomotives, the existing fleet of diesel locomotives, or new or improved diesel locomotives.

0.3.1.2.1 Electric traction

Electrification carries a special significance in Uzbekistan, as it specifically relates to the national choices made for energy supply.

Uzbekistan has limited oil resources, which are being exploited to the fullest possible extent, so as to reduce dependency on imports, and can target self sufficiency for those uses that require oil and oil products, but only for a limited period of time.

In the next twenty years however, the dominant sources of supply are and will be focused on electricity: coal, gas and hydropower based. This would put Uzbekistan in a situation comparable to France, though for different reasons, where electricity is the preferred power source and mainly based on nuclear power.

The net impact of this situation and this policy is relative prices for fuel and for electricity more favourable to electricity than would prevail on world markets, both for current prices and for shadow prices.

In this situation, electrification would be justified for the traffic levels encountered in the core triangle. Minor additions to the fleet of electric locomotives would be relevant, to the extent that the new locomotives would be used on the most productive directions, and their utilisation rate would be kept at the highest possible level – typically more than 200 000 km per year are achievable for shorter, quicker block trains operated between major hubs.

0.3.1.2.2 Diesel traction

For the remaining parts of the network, diesel locomotives should be the preferred mode of traction.

In the absence of significant improvements in the utilisation rate, and owing to the current oversupply of locomotives, no improvements nor additions are probably needed in the short term to the fleet, which should be allowed to run with mostly cannibalised spare parts.

Some of the newest units may be re-motorised, using newer design, more reliable, easier to maintain, and more energy efficient engines.

This could only apply to the locomotives in their first half life, and would probably extend their useful life by another ten to fifteen years.

This investment would however compete with electrification works for UTY's borrowing capacity.

Rationalising the maintenance, making the operational performance of the fleet reasonably foreseeable, and planning in detail for the future evolution of the fleet is an important and critical job, with a strong potential impact on the borrowing requirements of UTY. It would best be tackled by contracting out the maintenance of the fleet to a service provider that will have to meet exacting standards. This job would include the implementation of much needed information systems.

0.3.1.3 Track design and maintenance

0.3.1.3.1 comments on ADB's rehabilitation report

The ADB sponsored report has abundantly documented the need for improved sleepers and fastenings, and recommended that the track would be overhauled on most sections where the speed was severely restricted on the main line between Bukhara and Tchengeldy.

The criteria used for selecting track sections for relacement is based on a speed limit below 60km/h. From UTY's information however, it appears that

- track sections limited below 60 km/h are one half to one third of the track length to be included in the rehabilitation programme
- the most common cause for limiting the speed is deferred repair, as opposed to extreme rail wear (which would certainly require replacement)
- using 40 km/h instead of 60 km/h as a threshold would have resulted in a much smaller length of track (e.g. Tchengeldy Tashkent ... 1,5 km

Though this by itself does not obviate the necessity for track replacement, it serves to mitigate the immediate urgency.

0.3.1.3.2 technical choices

UTY is currently testing welding and fastening alternatives corresponding to world standards, in order to check on their applicability to conditions in Uzbekistan.

Pending satisfactory completion of the tests, overhaul of the track would be carried out using the tested equipment on the sections identified for replacement.



Beyond this limited but sizeable and potentially oversized overhaul, two fundamental questions remain unanswered:

- which speed limit should the track allow, on various sections of the track? It can be argued that higher volume justifies higher speed, as there is more need for capacity, and as the higher speed allows higher savings in immobilisation time for rolling stock and their contents; actual decisions have however to be made, which would then be built into a formal multi annual maintenance plan
- how and on which criteria should maintenance works be carried out? Periodic full overhaul is a
 costly proposition, that may be replaced with more focused works, to be carried out when
 specific conditions are met

Current rules apparently do prohibit that sleeper and fastening devices of different designs be installed on the same track section. These rules do preclude a gradual replacement of sleepers and fasteners by routine maintenance crews, and would therefore call for a complete overhaul.

As these rules do not exist in some other countries, apparently without adverse consequences, mixed designs should be pilot tested in Uzbekistan.

0.3.1.4 Scope of services

The scope of services to be offered by UTY should be related to its anticipated role.

0.3.1.4.1 Maintaining and making available the infrastructure

The central role of UTY is to keep that part of the track and related facilities that is considered as a national strategic asset in proper condition, and make it available to transportation companies that have been cleared to operate trains.

Maintenance works themselves do not have however to be carried out by UTY, and could be sub contracted, if competition would allow related services to be better or cheaper. This would obviously not apply to routine manual maintenance, but could apply to relaying.

0.3.1.4.2 Maintaining locomotives and making traction services available

The maintenance of locomotives needs not be carried out by the public operator who is also in charge of the track. It can be carried out by a special purpose division of this operator, with a separate set of accounts, so as to ensure full visibility and accountability.

It can also be carried out by a third party, who will by contract guarantee a stated level of availability of the locomotives (typically 90 to 95%), and insulate the operator from all problems related to scheduling maintenance works, procuring spare parts, and procuring hard currency for such purchases.

In addition, separating ownership and use of the fleet would encourage users to achieve better utilisation rates.



0.3.1.4.3 Operating passenger trains

Operating passenger trains, and doing so at regulated prices may be considered a social obligation. In this case, a public service obligation may be imposed on an operator. If no other operator would be willing to cope with this obligation, there would be little option but to retain it within UTY.

Public service obligation should however be carefully considered and dimensioned, as it potentially creates a serious drain on public resources or on the resources of the operating company.

It must be stressed that this obligation can be discharged by the road transport operators.

In addition, transferring the responsibility for local services to local communities would allow them to pool the provision of local transportation services using all available means, for better economies of scope.

0.3.1.4.4 Operating freight trains

Freight trains may be operated by the public operator, by own account hauliers, and by third parties. They should operate at a profit, at least when dealing with their commercial customers.

The public operator typically has the breadth of coverage which allows him to serve all publics in a satisfactory way.

Own account hauliers however often have little use for any services beyond seeing their wagons pulled between two points, would not want to pay for more, and could get organised by themselves to deliver most of the service. They already are doing it on their private networks (e.g. Almalyk), and could expand on the public track without compromising safety nor economic efficiency.

Similarly, third parties owning their rolling stock, or with a privileged relationship to clients or communities (transport organisations) may wish to offer a separate service, and define, organise and sell it themselves.

0.3.2 Opportunities for improvement

Potential for improvement does exist in maintenance and operations, and is accessible through the use of a mix of up to date information systems and different management practices.

Savings would result somewhat from reduced manpower and possibly reduced maintenance and operating costs, and most importantly from reduced or deferred need for capital spending. Given the magnitude of the capital spending requested by UTY (2B US\$), it is the consultant's opinion that short term savings are to be achieved by getting organised to defer capital spending, while longer term savings will result from staff reductions and better efficiencies.

The MIS report lists all information systems that would contribute to a better control of the company, to better efficiencies, and to better service. This report is comprehensive, and therefore will not be discussed in detail here.



Most improvements relate to the implementation of specific policies (others would relate strictly to the use of information systems or optimisation tools).

Area for improvement	Nature of improvement	Requirements
MAINTENANCE OF TRACK	Deferred expenses	Definition and enforcement of maintenance policy based on monitoring of actual condition of track and on traffic forecasts and history selective maintenance
Maintenance of rolling stock	Improved availability	Use of replaceable units improve availability of replaceable units and spare parts
TRAIN SCHEDULING	Improved utilisation rate of locomotives/ all rolling stock	Concentrate operations on fewer hubs INCREASE LENGTH OF UNINTERRUPTED RUNS Run shorter trains if needed
SECURITY CHECKS	Increased speed / improved utilisation rate of rolling stock	Re-examine checking policy for economic impact, likelihood of failure, and security risk (braking tests on all wagons after change of locomotive, hot box,)
MARSHALLING OPERATIONS	Reduced handling or cost of handling in marshalling yards	Concentrate operations on fewer hubs (3+3) .Automate large marshalling yards
TERMINAL OPERATIONS	Reduced handling cost	Shut down terminals or transfer to customers (who can get organised locally more efficiently)
PASSENGER TRAINS SCHEDULING	Improved utilisation rate reduced energy cost	Adapt capacity to demand (shorter or less frequent trains)
SERVICE ON PASSENGER TRAINS	Increase traffic and revenue per passenger x km	Improve overall service Improve collection of fares Improve availability of on board services

Management information systems do not directly lead to economic benefits; they are however the tool that ensures that decisions are carried out for an economic benefit (before the fact), and that allows to measure the impact of decisions and to make managers effectively responsible for results.

They must be considered as a critical enabling factor, and therefore deserve highest priority. Most important are integrated accounting / budgeting tools, and maintenance management systems. Improvements may also be expected from changes in the institutional set up, though it may be difficult to assess them positively.

For instance, the divisionalisation of passenger services with the requirement for a balanced budget will most probably result in many minute operational changes that would add up to significant savings, and encourage measures for an increased collection of fares. It will also help implementing an investment freeze.

Further divisionalisation and organisation in profit centers would have similar effects.



0.3.3 Opportunity for immediate action

Immediate action is needed in the following areas:

- track rehabilitation of the sections posing a safety risk
- implementation of computer assisted maintenance for track and fixed installations, and definition of a maintenance policy
- implementation of computer assisted maintenance system for locomotives; and definition of a maintenance policy, including the use of replaceable units
- implementation of management information systems and of budgeting practices
- implementation of institutional changes, leading to improved focus and economic accountability of individual units (see "institutional issues), building on the initial move for passenger services

The need for investment is documented in chapter 4.

0.3.3.1 Track rehabilitation of the sections posing a safety risk

Wherever extreme rail wear has been spotted, and where signalling proves regularly defective, quick corrective action is needed for the sake of safety, or in order to prevent unacceptably slow operations. This is the basis for the maintenance requirements set out in the investment plan.

It fits well within the plans proposed by ADB, though we recommend a lower spending level.

0.3.3.2 Track maintenance

Real time monitoring of the track condition, operation of a maintenance related computer system, implementation of a maintenance policy based on conditional operations are critically related issues that deserve quick action.

The MPS paradigm – traffic (or time lapsed) -> theoretical wear -> systematic overhaul – has to be replaced by a more cost effective paradigm: – traffic economics -> economic design speed; monitoring of track condition -> anticipation of problem areas -> definition of cost effective maintenance programme -> continuous implementation of minor repairs –.

Only extreme rail wear requires immediate replacement; otherwise, simple, cost effective corrective action can be undertaken on a continuing basis on ballast and sleepers / fasteners separately, and scheduled so as to provide continuous employment to the UTY experts in charge of the works.

This should be the basis for works to be carried out by maintenance specialists, who can rely on proven information systems.



0.3.3.3 Locomotive maintenance

Locomotive maintenance similarly requires the implementation of up to date information systems and a conditional maintenance policy; an additional factor for the existing fleet is the management of the gradual phasing out, with systematic, planned cannibalisation and the increased used of replaceable functional units.

This could be implemented within the framework of a maintenance contract.

0.3.3.4 M.I.S. and budgeting

The success of the reorganisation being progressively carried out at UTY hinges on the right economic choices being made at all levels within the organisation, which in turn hinges on the instant availability of relevant financial and economic information, that furthermore are needed to keep managers of UTY accountable for the results of their activity.

This typically involves a multi-year consultancy cum software contract awarded in a competitive bidding process.

0.3.3.5 Institutional changes

The process for deciding on, and implementing institutional changes is well under way.

Adapting the law is a matter for Majlis, UTY and the Government to agree. Pragmatists in Uzbekistan consider that laws will be more easily enacted when the underlying practice will have established itself.

Empowering the State to exercise its role fully and to effectively control UTY while allowing it to have managerial independence and responsibility is an urgent necessity. All transactions must be transparent.

Organisational and managerial issues are time critical in ensuring the success of the restructuring of railway transport in Uzbekistan: dividing up UTY into focused Profit Centres is an urgent requirement

0.4 Investment requirements

The following two tables summarise our understanding of the investment needs that UTY can and should finance. Brief individual comments follow the tables.

They focus on the next five years, while identifying the portion of each investment package that would need financing beyond the five years term.

The two tables "Investment – High" and "Investment – Low" – differ in the presumed ability of UTY to repay the corresponding loan. Choosing a situation in between is a matter for UTY and potential lenders to discuss.

INVESTMENT REQUIREMENTS - « HIGH »										
High Hypothesis	Cost	Cost	Schedule					postponed		
	5 years	total	01	02	03	04	05	beyond	Notes	
Rolling Stock	154,5	162	32	30	58,5	26,5	7,5	7,5		
Spare parts	5	5	1	4					emergency only - excluding subsequent maintenance	
electric locomotives	38	38			19	19				
diesel locomotives	56	56	8	16	32				re-engining 40 @ 1400K\$	
freight wagons	7,5	15			2,5	2,5	2,5	7,5	purchase 600 tanks @ 25K\$	
passenger carriages	20	20		5	5	5	5		re-habilitate 400 @ 50K\$	
Diesel locomotives Depots	5	5	5						upgrade	
Uzbekistan Depot	3	3	3						upgrade	
Locomotives workshop	5	5	5				•		overhaul unit	
Coaches Depot and Workshops	5	5	5		***				paint shop, wheel shop, materials handling	
Wagons Depots and Workshops	10	10	5	5					6 regional units to be overhauled	
Infrastructure	52	52	10.5	10.5	10.5	10.5	10.5	0		
Track	50	50	10	10	10	10	10		only most severely damaged sections and small maintenance equipment; excludes	
Signalling	2	2	1	1					on-going maintenance	
Electrification	110	110	22	22	22	22	22			
Mekhnat-Dzhizak	27	27	17	10					only remaining works	
Djambai-Marakand	10	10	5	5					only remaining works	
Marakand depot	7	7		7					necessary for south of network	
Marakand-Bukhara	66	66			22	22	22		excludes new signalling, improvements to the track and 50% of hi-voltage lines	
MIS	15,5	15,5	4,5	6,5	4,25	0,25	0		-	
hardware	10	10	2	4	4			1	more detailed schedule available	
software & support	5,5	5,5	2,5	2,5	0,25	0,25				
	332	339,5	73.5	75	99. 5	59.5	40	7,5		
signalling & telecommunications are to be added (Module E)			15.5	,,	77. 3	ر.ر	70	,,,		
excluding foreign technical assistance to the restructuring process		sistance								

			ES I IV	TELVI.	KEQU	IKEM	LNIS	- « LOW	»	
	Cost	Cost	Schedule					postponed	1	
	5 years	total	01	02	03	04	05	beyond	Notes	
Rolling Stock	68,5	81	19	2	4,5	21,5	21,5	12,5		
Spare parts	5	5	1	2	2	2			emergency only - excluding subsequemaintenance	
electric locomotives	38	38			 	19	19		- Additional Control of the Control	
diesel locomotives	0								dropped - less of a priority that reducing borrowing	
freight wagons	7,5	15			2,5	2,5	2,5	7.5	purchase 600 tanks @ 25K\$	
passenger carriages	0								dropped - to be undertaken b Passenger Services	
Diesel locomotives Depots	5	5	5						1 assenger Services	
Uzbekistan Depot	3	3	3							
Locomotives workshops	5	5	5			 				
Coaches Depot and Workshops	0								dropped - to be undertaken b	
Wagons Depots and Workshops	5	10	5		<u>_</u>			5	Passenger Services 6 regional units to be overhauled	
nfrastructure	52	52	11	11	10	10	10	0		
Track	50	50	10	10	10	10	10		only most severely damaged section and small maintenance equipment	
Signalling	2	2	1	1					excludes on-going maintenance	
Electrification	37	110	9	9	9	5	5			
Mekhnat-Dzhizak	27	27	9	9	9				only remaining works	
Djambai-Marakand	10	10				5	5		only remaining works	
Marakand depot	0	7					-+		necessary for south of network	
Marakand-Bukhara	0	66						66]	postponed, as it is not affordable in the	
⁄IIS	15,5	15,5	4,5	6,5	4,25	0,25	0		onor term	
ardware	10	10	2	4	4	_ c, 	- 		more detailed schedule available	
oftware & support	5,5	5,5	2,5	2,5	0,25	0,25				
	184.5	258.5	48	31	32	37	36.5	49		
signalling & telecommoe added (Module E)							20.5			
excluding foreign tech o the restructuring process	nnical assi	stance		_						

0.4.1 Rolling Stock

Investment in rolling stock includes new or refurbished rolling stock, and improvement in facilities.

Refurbished rolling stock is only recommended if it brings commercial or safety related benefits. Improved maintenance and refurbishing are a cheaper alternative to purchasing anew; they also require sizeable investment in facilities.

New rolling stock is only considered if it leads to significantly better efficiencies, or is a requirement for a better service.

The low hypothesis:

- drops the re-motorization of diesel locomotives, as a comprehensive programme (spares, system, possibly third party contracting) to maintain the current fleet would meet UTY requirements for the next ten years, before new purchases would be envisaged
- makes refurbishing of passenger carriages and investment in depots a task to be performed by "passenger services unit" if they can afford it, which is still undecided
- postpones part of the investment in depots for wagons to better times

0.4.2 Infrastructure

Investment in infrastructure includes the most urgent repairs to the track and signalling, justified on reasons of safety.

Further spending is considered as maintenance spending rather than investment.

Furthermore, the general opinion expressed in this report is that maintenance should be carried out on an ongoing basis as required rather than on programmed relaying.

0.4.3 Electrification

Electrification works are justified on the main "Silk Road" between Tashkent and Bukhara, for the works still to be done.

Depending on UTY borrowing capacity, different speeds of implementation are possible.

0.4.4 MIS

MIS focuses on the more urgent issues, and should not be downgraded. Conversely, systematic use of modern, integrated MIS at UTY will require a significant adaptation from UTY managers, and it may be unreasonable to carry out more.



0.4.5 Signalling and telecommunications

Telecommunications will be addressed by module E of this project.

It may be argued that the signalling area will require significant investment, as the technical condition is generally poor, and overhaul is considered uneconomic.

The same case applies however for continuing maintenance.

0.4.6 Foreign technical assistance

FTA is not included in this estimate, as typically UTY would receive it as a grant from various institutions.

Possibly 15-20 man years are needed in the next 5 years to accompany the process.

0.5 Institutional issues and the restructuring process

Institutional issues are paramount to the success of the overall re-structuring undertaking. USSR railways were operated on a continuous basis, at or near full capacity, and all processes were designed to make the best out of it.

The current re- structuring of UTY follows the forced re-structuring of the Union and of the economy as a whole.

Many decisions have to be taken, collectively resulting in UTY and its constituent parts downsizing while improving the quality of services offered, and possibly postponing needed investment as much as possible.

The two single most important factors to be taken into account are commerce and economics i.e. making sure customers get what they want and are ready to pay for, and making sure that decisions at all levels contribute to economic efficiency.

A complicating factor is the near monopoly situation enjoyed by the railways in certain markets. This could reduce the urge to contain costs and keep customers happy, to the detriment of customers service and the community as a whole.

In essence, restructuring means:

- · allocating new, well defined and well enforced roles for the staff
- adjusting the means of production to the level of demand, i.e. manpower, facilities, equipment
- while modernising the practices to insureimprovement in quality and efficiency

Multiple targets have to be defined, to meet the requirements of the market in a cost effective way. These targets would be allocated to subsets of UTY, and would focus on a limited number of objectives in the appropriate areas.

The problem is to complex to define preciscisely in advance in technical and human terms; it will be refined in due course.

Three subsets may be identified: regulation, organisation, and the re-structuring process itself.

0.5.1 Regulation

Regulation deals with the relationship of the railway sector with the community, and the way control is being exercised, i.e. the role of the State, and the balance of power between the different entities contributing to the provision of railway transport services.

Three roles must remain within the State: safety of the public, availability of transport services at a fair price, and return on the money invested in the assets. The second role entails making sure that the assets are kept in proper operating condition. Typically a State or State appointed body, or bodies, independent of the railways, covers the three roles.

Safety standards should be defined by the State, and compliance checked and enforced.

Whenever the market would not spontaneously provide for it, the provision of services should be prescribed (so called Public Service Obligation), in co-ordination with the supplier and its clients, and prices negotiated.

Acting as owner, expecting a return on investment, or acting as representative of the general public, the State expects economic efficiency: high demand, high capacity utilisation, and efficient use of assets. This is typically embodied in a document prepared by the operator and approved by the State, called Performance Agreement, which outlines the objectives to be met and the degree of freedom of management.

It matters that Safety Standards, Public Service Obligation and Performance agreement be defined, that a State organisation be created to monitor them, and that monitoring mechanisms be implemented.

This need not apply to a monolithic organisation.

0.5.2 Organisation

UTY will require a new organisation to enable it to perform efficiently and effectively in a market led economy. It must be in a position where it can react swiftly to business opportunities. It must have control over its costs and make an adequate return on capital used in accordance with Government requirements. The new organisation would be based on Profit Centres which would be grouped to measure the financial performance of the different units. Infrastructure must be managed on a stand alone basis and charge operators for the use of the track. It is envisaged that in the longer term private operators would have access to the track and would pay the same charges as the state company. The recommended MIS would provide the basis for financial control and monitoring.



The existing undertaking would be broken down into a number of Business and Service Units. Ther would also be provision for Administration and Corporate functions.

The Units would be as follows:

Passenger Business Unit Freight Business Unit Rolling Stock Service Unit Infrastructure Service

They would enjoy limited independence within the policy and direction of the Corporation. Transactions between the Service and Business Units would be carried out on a commercial basis. It is envisaged that in the longer term tenders for service would also be issued to the private sector.

0.5.3 Re-structuring process

Given objectives and a measure of the task, each unit can define roles and performance criteria for their managers, and evaluate future manpower requirements.

At this stage, it could be said that manpower should fall roughly back in line with the fall in traffic. It is however not a strong priority at this stage, as wage level is moderate. Moreover, salary at UTY is often paid on a work load basis, i.e. the "value" of the work is shared between participants.

Medium term targets (30 to 50% reduction) should be kept in mind in negotiation future performance agreements.

In the short term, the stress should be on promoting management processes more adapted to the changed and changing environment, and to train a limited number of people in implementing them.

Most managers and key professionals would be selected for intensive training, as would a number of lower ranking people. Numbers required for other staff would be managed as part of the performance plan(s).

This is why the stress was put more on the process than on the numbers.

In order to anticipate on the process, a survey was carried out of mid level managers, so as to gain their commitment to a future reinforcement of the human resource management systems.

0.6 Financial issues

A detailed review of costs have been made by the Consultant, and projected into the future. The Consultant looked at such issues as profitability of the services, costing and pricing, revenue base, downsizing or rightsizing, separately for passenger services and for freight.



0.6.1 Costing

0.6.1.1 Depreciation

The single most important financial issue is the amount that should be charged to depreciation for the vast quantity of assets. Charging a fraction of historical value is obviously a serious understatement of costs; charging replacement value using USSR inherited maintenance practices and international prices would also be unacceptable.

The depreciation policy needs to be changed to ensure that the financial results of the railway reflect the cost of providing for the assets at current market prices. A separate asset replacement reserve should be created in the Balance Sheet in line with standard accounting practice.

0.6.1.2 Allocation of costs

Revenue does not only fall on "freight" and passenger services; a long list of ancillary services represents more than a third of total revenue, covering sales of services to third parties, sales to passengers, handling charges for freight, ... and items considered as a cost in other parts of the business.

Given the amount of time imparted to this work, and the degree of detail given by the existing management information systems, only a rough allocation between passengers and freight could be carried out, in order to evidence their relative profitability.

As direct revenue from the passenger business only represents about one tenth of total revenue, no specific effort was made to allocate overhead to freight. UTY being considered a "freight" railway, would charge overhead to the freight services. Unless specified otherwise, joint costs are charged to freight.

An ideally effective exercise would also have split freight in domestic and international, and in rail only vs. multimodal, even though as of today, rail only, domestic only accounts for the lion's share.

0.6.2 Profitability and pricing

As it stands, even with reduced overhead charges, the passenger business has negative cash flows, while the freight services do contribute to covering depreciation charges.

0.6.2.1 Passenger

Passenger services are visibly oversized (average use of capacity is below 50%), and fare evasion is said to be a significant drain on potential revenue.

Furthermore, competition from road transport is fierce; as things stand, road transport is similarly priced, and is significantly quicker. Rail transport is possibly safer and more comfortable.



The potential for price increases is therefore quite limited.

UTY has already started a restructuring exercise, with the stated purpose of bringing passenger services back to economic equilibrium.

0.6.2.2 Freight

Freight services are profitable on a cash basis, but would not cover the long term replacement of assets needed for operations.

Current prices are low by international standards (1USc/Txkm) and could be raised marginally to help cover the level of costs, even if it is only in a transitional period, during which restructuring costs would be incurred.

0.6.3 Downsizing

Downsizing is needed, and should take place in the next five to ten years.

The study previously commissioned by ADB made rough estimates on the level of reduction in staff level needed over the next years, which correspond to international practice.

More important that the actual level is the process chosen to do it, which would minimise social consequences and potential short term disruptions to the service.

Also quite important is the allocation of staff to each individual unit, which will be the result of a continuing budgetary process over ten years.

0.7 List of individual thematic reports / annexes

Investment related:

- 1. Electrification
- 2. Track and signalling
- 3. Rolling stock
- 4. information systems, including track maintenance

General:

- 5. Legal and regulatory matters
- 6. Economics
- 7. Human resources
- 8. Financials

A short description of each individual report follows.



Investment related

0.7.1 Electrification

The purpose of the electrification report is to assess the economic feasibility of further electrification of the UTY network, and to recommend a related investment package.

It specifically addresses the track sections:

- Mekhnat Dzhizak
- Dzhizak Marakand
- Marakand Bukhara

A base case, with appropriate data, giving traffic thresholds for the electrification to be economically effective was developed.

The provision of a running depot in Marakand becomes more relevant for the ease of operation as the network expands; a summary evaluation pools the three projects, and allocates the cost of the depot to the whole project.

Investment cost items taken into consideration include poles, catenaries and suspensions, differences in acquisition costs for locomotives (corrected for availability rate), substations, and part of the high voltage feeder lines. They also include whenever applicable modification to civil structures required by electrification, but exclude improvements to the track that would make electrification more effective. They exclude.

Running costs being compared include energy, maintenance and crews. They exclude depreciation as evaluations are carried out on the basis of multi annual cash flows.

Its result is a firm "go" recommendation to proceed with finishing the works on the first two sections, and a weaker recommendation to proceed between Marakand and Bukhara, possibly implementing in two phases, as the first section between Marakand and Zievuddin (Navoi) has a significantly larger traffic base (because of the Utch Kuduk branch, predominantly orientated towards Tashkent, and because through international traffic is not so important).

These recommendations are based on the hurdle rates used by the EBRD team, namely 11% IRR for unconditional "go", and 7% for conditional one.

0.7.2 Track and signalling

0.7.2.1 Track - fixed installations

An evaluation of the emergency requirements of the high traffic sections was made, based on statements made by UTY, and on a field visit made to Samarkand and Dzhizak.

Non emergency requirements are presumed to fall under a budget line related to maintenance.

Other sections are presumed not to justify a large investment in the upkeep of the infrastructure.

0.7.2.2 Signalling and telecommunications

Same comments.

For less than urgent requirements, a detailed evaluation of the telecommunications requirements is to be carried out under module E of this study, to be later integrated.

0.7.3 Rolling stock

The rolling stock report summarily evaluates the capital needs for:

- new rolling stock, primarily locomotives and tank wagons
- bringing maintenance facilities up to standards allowing effective maintenance practices
- emergency spare parts
- overhaul of carriages

A comparison is carried out of the different modes of traction: diesel and electric, including the case for installing new diesel engines in existing units

0.7.4 Information systems

0.7.4.1 M.I.S.

The M.I.S. report is a comprehensive review of the major computer assisted processes, existing at UTY or effectively in operation at other railway companies. It recommends focused implementation of the most critical systems.

0.7.4.2 Track maintenance

A specific visit was organised with the purpose of assessing the current maintenance practice for track and fixed installations, and recommend changes that would have an impact on the life cycle cost of the track.

The report documents the information flows related to maintenance, evaluates the resulting decisions, and recommends changes to the practice and a specific investment in information systems.



Guidelines are given for defining a maintenance policy that meets today's requirements, that stop short of actually defining it.

0.7.5 General legal and regulatory matters

0.7.5.1 Legal issues

The report on legal issues examines the current situation of UTY and the railway sector in Uzbekistan, as defined by the existing legal instruments, and by the drafts being circulated.

It recommends taking advantage of the current discussion on legal issues in the transport sector to create a framework for the railway sector (rather than for UTY, who is "only" the most important player"), that will allow for a clear separation of infrastructure and operations, will make each unit directly accountable for its own performance, and will make day to day management easier.

The main instrument governing the relationships of railway transport operators and the state would be a "performance contract", which stipulates the conditions (economic, operational, quality, ...) to be met for the operators to operate relatively free of direct government intervention

0.7.5.2 Regulatory issues (role of the State)

The regulatory report examines the potential relationships between the State and UTY, whereby a clear distinction should be made between both.

The State should concentrate on (i) defending public safety, (ii) defending public economic and social interest, (iii) ensuring proper use of State owned assets, letting UTY getting organised to meet stated objectives under stated constraints.

This supposes the creation of specific State organisation(s) to exercise the corresponding responsibilities.

0.7.5.3 Organisational issues

The organisational report recommends that UTY be "administratively" ⁷split between units with a clear focus, dealing at arm's length with one another, individually meeting stated objectives, and able to serve third parties in a non discriminatory way.

0.7.5.4 Working papers

Four working papers were exchanged during the course of the assignment with UTY. They helped to achieve a common understanding with UTY on the underlying issues. Their primary focus is to analyse specific issues on a piecemeal basis. The four documents deal with: (i) overall institutional issues, (ii) passenger services, (iii) corporatisation, and (iv) mobilising UTY assets.

there is no strong need that individual units be corporatised; they can be managed separately under a single corporate umbrella



0.7.6 Traffic forecasts and operation

0.7.6.1 Existing traffic

This section present the past and actual figures in terms of traffic and several informations on operations (such as number of trains per section).

0.7.6.2 Traffic forecasts

This second section shows traffic estimates in terms of number of trains by section on two scenarios: optimistic and pessimistic.

It also includes some analysis of the impact of the construction of a pipeline.

0.7.6.3 Economic justification of investments

This document summarises the results of the economic analysis carried out on each of the investment proposals.

0.7.6.4 Tables

See Chapter 5 - Operations and Traffic Analysis.

0.7.7 Human resources

0.7.7.1 Summary report

The Human Resources report focuses on the process of restructuring, and deals with the most significant issues that will have to be addresses by UTY in the course of restructuring, while outlining possible solutions.

0.7.7.2 Annex: questionnaire and results

Anticipating on the restructuring process, a questionnaire was widely circulated and discussed with managers of UTY and their respective supervisors, aiming at defining what the position is about, what skills it requires, and to which extent the incumbent has them.

0.7.8 Financials

0.7.8.1 Financial report

The accounts of UTY have been restated in order to accommodate economic costs and be closer to what international accounting standards have produced. These accounts were then projected.

0.7.8.2 Costing report

The costing report differentiates costs between relevant activities.

0.7.8.3 Controlling

The controlling report issues recommendations on how UTY could and should implement integrated, comprehensive controls covering all economic and financial functions of the company.

0.8 Future technical assistance

BACKGROUND AND OBJECTIVES

It is recommended that there will be technical assistance to continue the momentum of this Restructuring Study. There are planned institutional improvements needed by the railway in its move from a traditional railway towards a modern efficient commercially driven organisation as it moves into the 21st century. There is also the likelihood of an associated investment programme funded by International Funding Institutions such as the EBRD.

There are two main areas where technical assistance is recommended. Firstly there is a need to support the implementation of restructuring. Restructuring is a major change and there can be many difficult steps. There is a requirement for support for railway management through this complex process. It is likely that the first element of assistance would be over 18 to 24 months.

Secondly, the implementation of investment programmes brings new demands to the region in terms of skills in developing international specifications and procurement procedures. The IFIs usually also require Business Plans as part of the conditionality of the loan finance. Thus there is need for support for implementation of the investment programme.

Thus it is proposed to have technical assistance with the following objectives:

(a) Institutional

To support the railway management in the following areas:

- changing the management structure towards that of a commercially driven and profit conscious company
- institutional, legal and corporate changes
- preparation of a rolling 5 year detailed Business Plan
- the introduction of modern accounting practices and costing procedures
- Human Resources development to support the major changes arising from the restructuring programme
- the identification of a MIS system suitable for the requirements of a modern railway.

(b) Implementation of Investment

• Support for establishment of a Project Implementation Unit (PIU) to implement the investment programme.

METHODOLOGY

Institutional

Consultants will be required to give support in the following areas:

Organisational Change

The consultants will advise the senior railway management on the management of change from the traditional organisation to the new management structure.

The consultants will prepare a Master Plan to cover the overall change process. This will include guidelines for individual change in each of the chosen organisational units. Advice will be given on the description and implementation of the detailed organisation structure down to operational levels.

The consultants will monitor progress for change in each organisational unit and report back to the railway management on progress. They will assist management in resolving difficulties that may arise and in advising on corrective action to maintain the momentum of change.

Human Resources

In tandem with the institutional and organisational changes, the consultants will help with initiatives in Human Resources development. The programme will include manpower planning and communications as well as any planned retrenchment and reorganisation.

The consultants will advise on requirements for training. It is likely that training will cover

- marketing skills
- management skills
- financial skills
- information technology

as well as Maintenance, Engineering and Operations.

Strategic and Corporate Planning

The consultants will assist senior management with the development and preparation of a long-term strategic view for the railway. They will help with establishing the business planning function in the railway and will present a template for a detailed 5-year Business Plan, which is upgradeable. This will be done at an early stage to assist with compliance with IFI loan arrangements.

Introduction of Modern Financial Systems

The existing accounting systems of the railway need to be upgraded to provide the management with the information they need to perform their functions. This task will be carried out in conjunction with the introduction of modern MIS as the two areas are very closely linked.

Priority will be given to the improvement of the internal management accounting systems and the development of cost accounting techniques. Particular emphasis needs to be given to the creation of profit centres and the identification of revenues and costs associated with each.



Costing must be integrated with the new financial accounting system to ensure that the same source data is used in the preparation of all management information. The costing system must ultimately be integrated with the MIS system. There is need for development of a training programme to introduce a greater degree of awareness of the necessary modern financial analysis skills.

Introduction of Modern MIS

It is necessary to begin the task of putting in place the hardware and software infrastructure and support services needed to deliver the Information Technology improvements for the railway. The consultants will give assistance on this.

Performance Agreement/Legal Changes

The consultants will give advice on the composition of a Performance Agreement, which will determine the relationship of the railway with the Government in the context of the new role of the railway in a market economy.

Assistance will also be needed to support associated legal changes.

Operational Improvements

The consultants will give support for introduction of operational and technical improvements such as improved operational efficiency coupled with investment in infrastructure, rolling stock, signalling

It is likely that experts in the following areas would be required for this Technical Assistance

- Organisational
- Human Resources
- Finance
- Business Planning
- MIS
- Operations
- Legal

Assistance with implementation of the Investment Programme

The consultants will provide for the set-up of a Project Implementation Unit in the railway. Experts from the railway will primarily staff it.

The duties of the PIU would be to implement the investment programme.

The PIU would carry out its duties in all parts of the procurement cycle in accordance with the requirements of the IFIs: to establish (a) a system for preparation of specifications, (b) tender



dossier, (c) contract documentation, the tendering procedures including shortlisting and prequalification (if appropriate), issue of tender documentation, receipt and evaluation of tenders, awarding of contract, monitoring of implementation, quality control.

The consultants will support the PIU in its activities throughout the procurement cycle. A training programme in relevant areas of procurement, project implementation and loan administration will be required.

Technical experts will also required for preparation of the technical specifications.

Their disciplines will reflect the precise components of the investment programme but can include the following areas

- Infrastructure
- Rolling stock
- Signalling and communications
- Electrification

0.9 Regional cooperation

INTRODUCTION

There is good co-operation between the Railways of the Central Asian Republics and there is no reason to believe that this will change. The railways all use the same rolling stock, the same track standards, and rule books. There is even a common operating language, i.e. Russian. However, interoperability standards have to be maintained. Maintenance procedures have to be modernised and improved on. There are many advantages to be gained from joint purchasing of equipment including spare parts. The railways have to be marketed as a unit to improve their competitiveness in the international market. IT systems must be seen as a unified system to avoid duplication and the limitation of capability.

In the EU considerable efforts have been devoted to ensuring efficient interoperability, better management and more transparent financial transactions. The institutional position of the railways has been improved and a number of new laws drafted to ensure that there is harmonisation of competition between the different modes. As a result the point of view of the railway has become clearer in the political area resulting in a more sympathetic understanding of the problems of railway transport. The future of the railways in the EU is now irrevocably bound up with continuing cooperation and closer working between the different systems. It is recognised that the railways have a major role in the development of the common market.

A Regional Collaboration Conference, funded under the TRACECA programme, was held in Dublin from the 31st March to the 4th April 1998. Senior representatives of the railways of Kazakhstan, Uzbekistan and Turkmenistan attended this. There was an extensive discussion on areas of possible regional co-operation. A protocol (attached) was signed on behalf of the participating railways which undertook to see how and when further regional collaboration could be further progressed.

Collaboration among the Central Asian Railways is just one part of the greater picture of collaboration in all sectors of the economy in the region. Considerable economic benefits are to be gained through this approach.

Below are listed the areas for development of future co-operation. Some of the topics are complex and there is a need for further examination and elaboration. It is recommended that technical assistance be provided to support the efforts of the railways in this area, with a view to a steady increase in universally beneficial regional collaboration.

POSSIBLE AREAS FOR DEVELOPMENT OF CO-OPERATION

Intermodal Traffic

The TRACECA Study on Tariffs and Timetabling, carried out by SISIE-Calberson, identified a number of problems in the intermodal area. Rail costs are good generally by comparison with road. There are however bottlenecks on the TRACECA route, notably at Poti where the intermodal facilities are overloaded and the rates are high. This situation is being dealt with by investment in port facilities. Marketing is not good. Price alone will not attract the desired business volumes. The route must be sold to shippers.

The study identified the need for improvements in:

- · Pricing and invoicing
- Documentation
- Conditions of carriage
- Information

The conclusions reached in the study were that there should be:

- Improvements of services for western clients including simple documentation and direct trains
- New pricing policy including more flexibility
- Improved marketing
- Implementation of common operator principle



Implementation of the common operator principle will require that a company or joint entity be set up. It will be necessary to:

- Select a key man as the Managing Director.
- Appoint Board of Directors
- Incorporate the Common Operator Company under private law
- Institute a new law based on European model
- Ensure adequate capitalisation
- Ensure open competition

The potential for increased intermodal business is substantial. To improve market share the railways must increase their co-operation and improve their performance, as already outlined.

The railway companies have some reservations about the proposals but it is anticipated that with further discussion, the difficulties can be overcome. A further study on an intermodal company is scheduled to start in May 1998.

Rolling Stock Purchasing, Leasing and Maintenance

The consultants are of the view that there is a limited potential for increasing co-operation in the maintenance area between the different railways. Generally the distances involved are very long so that moving rolling stock around to other systems workshops would give rise to decreased availability and would reduce the potential for dealing with breakdowns and emergencies. There are, however, some areas in which maintenance is shared on an advantageous basis, notably Kyrgyzstan. Tadjikistan and Uzbekistan.

There is considerable scope for improving maintenance performance through the use of replacement units. This practice needs to be introduced in all the states. Rolling stock availability could be improved enormously if replacement units such as engines and electrical units were readily available to deal with failures on a plug-in basis. There is an obvious need for a centralised company/ics, which would repair such units on a production basis. As well as improving availability, this will also have the very desirable effect of improving engineering standards thus further enhancing performance. A company of the type required could be set up on a joint venture basis with the involvement of all the railways.

In the longer term, consideration should be given to the setting up of a leasing company, which would provide rolling stock on long/short term leases. If required, arrangements could be made for the leasing company to maintain the equipment on a kilometre running charge. This principle is well established in Western Europe. The company could also expand into the area of purchasing, so that orders for the different companies could be pooled. There are obvious financial advantages arising from this form of large-scale procurement. This company could also be set up on a joint venture basis with participation of the railway companies.

Development of Regional Track Access



The principle of access to the infrastructure of the railway companies should be expanded and encouraged. It should be possible for trains, including locomotives to be operated outside their own particular system on an agreed basis. This will reduce time lost at border crossings and make for more efficient use of staff and equipment. It will also encourage competition, which should lead to better fares and qulaity of service in the passenger area.

Open access to freight operators, both private and public, would also result in improvements in efficiency, service and rates for customers. There are particular opportunities for block train operation here, whether within a national system or operated cross-border.

Infrastructure Charging

Implementation of the recommendations for the establishment of infrastructure departments and the introduction of a track charging system will provide a more realistic basis for traffic costing. Opportunity should be taken to review the charges for track usage between the different countries. Efforts will have to be made to arrive at a more flexible approach in this area so that new lines will not be proposed to obviate using the track in an adjacent system.

Interoperability

While all the countries at the moment are using rolling stock and equipment in accordance with former soviet standards, this position may change in the future. Some of the railways may purchase equipment from outside the CIS. It is essential that specifications for these procurements, while meeting international standards, should also be compliant with the present Central Asian (CIS) railway standards. Otherwise the danger is that new equipment and standards may hinder the present smooth interoperability.

A considerable proportion of the current rolling stock and other equipment of the railways is out of date and in need of replacement. This is a situation which is facing all the Central Asian Railways. They must ensure that the introduction of modern technology will be seamlessly inserted into the existing systems without any negative effects on interoperability.

A protocol on standards for the five railways should be discussed and agreed. Procurement procedures will also need updating and modernisation in a co-ordinated fashion. This is referred to elsewhere in this report under recommendations for technical assistance in procurement.

Information Technology

The installation of a modern IT system, supported by a new communications system is proposed for the Central Asian railways. Experts from the UIC are preparing proposals for the telecommunications system under Module E of this project. The report is due by June 1998. New hardware and software is envisaged to provide a platform for the necessary MIS systems. Transfer of information between the systems is an essential ingredient of the proposal. Common protocols will be necessary. This project will not realise the huge advances projected without maximum cooperation between the managers and experts in the different railway systems. There must be consultation at regional level on the procurement of hardware and software to deal with the common computer protocols already referred to and also to ensure that best possible prices are secured for the



installation of this equipment on an all system basis. Given that the software requirements are essentially the same for each country (although varying in scale) there is a clear advantage in common procurement of the IT package.

Marketing

The railway product must be presented and marketed as a single unit, both internally and internationally. The railways cannot be competitive without having a joint approach. An image must be created which will become recognisable to the public at large. A common approach to this must be established. It will in time be necessary to market the passenger services, particularly tourist traffic, abroad. This can obviously be done more efficiently, with greater impact and at lower cost, on a combined basis. It is also vital to market the freight services as already discussed in the intermodal section above.

Training Programmes

The railway sector in each of the Central Asian countries is generally well served with technical training institutes. However, in the move to the commercial restructured railway there is a need for training in disciplines new to the traditional railway, such as marketing, Information Technology, business management and organisation principles. It is suggested that this training should be organised on a regional basis to minimise costs and improve regional interaction.

TECHNICAL ASSISTANCE FOR SUPPORT OF REGIONAL COOPERATION

Implementation of the proposals outlined above to further collaboration between the railways requires high level commitment and the dedication of the relevant Ministries and higher railway management's. Appropriate railway experts will have to be assigned to various tasks. They will have to adapt to new technology and ideas. This process should be assisted by technical co-operation using external experts.

TRACECA: Central Asian Railways Restructuring Study TNREG 9602 Regional Collaboration Conference, Dublin 31st March - 4th April 1998

- 1. The Conference was convened in accordance with the Project TOR
- 2. This Conference has been funded by TRACECA under the European Union TACIS Programme.
- 3. Mr. B. Collins, General Manager of CIE Consult welcomed the delegates. He explained the objectives of the TRACECA Programme.
- 4. Presentations were made to the delegations of Kazakhstan, Turkmenistan and Uzbekistan by individual Team Leaders for the relevant study modules on the findings and recommendations of each module.
- 5. The delegates were addressed by a number of visiting speakers:
 - Tadeusz Kaczmarck, UIC, on the work of UIC in Module E (Telecommunications).
 - Bernhard Ziller, EBRD, on EBRD policy in the region
 - John Markham, CIE Consult, on European interstate co-operation experience.
 - Jean-Louis Romanini, Sisic-Calberson, on the TRACECA Tariffs and Timetable Study.
- 6. Areas of possible interstate co-operation were discussed. These included
 - · development of intermodal traffic proposals
 - · rolling stock purchasing, leasing and maintenance
 - development of training programmes
 - legislation for access
- 7. Other issues discussed included:
 - Railways accept the necessity to improve their performance.
 - The restructuring reports presented to the three countries will provide a basis for reshaping the railways.
 - The relationships between the railways and the State Administrations should be more clearly defined.
 - Prospects for investment should be further developed for submission to EBRD.
 - Efforts will be continued to promote co-operation at regional level.

progressed. Signed K. Tulemetov, DGM, KTZ. D. Saudabeyev, Chief GM, Rest I. Segal, Ilcad of Railways Dept., Ministry of Transport, Kazakhstan N.E. Ermetov, Chairman, UT V.L. Davidovitch, Head of International Relations, UIY Z. Mirkadyrov, Senior Experi Cabinet of Ministers, Uzbekistan H. Berdiev, First Deputy Gener J.F. Higgins, Project Director, CIE Consult / Systra

It was agreed that further contacts would take place between the three

administrations concerned to see how and when these matters could be further

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ANNEXE 1 - DRAFT PERFORMANCE AGREEMENT



1. State / Railway Relationships

1.1 Introduction

1.1.1 Need for new structures

The internal reorganization and other recommendations contained in this report will not be sufficient to prepare Uzbekiston Temir Yullary for the future challenges. As is the norm in the Western European countries, the railway management will require the appropriate degree of entrepreneurial autonomy if it is to survive and perform well in the coming national and international transport markets. This can only be achieved through a restructuring of the relationship between the State of Uzbekistan and Uzbekiston Temir Yullary.

1.1.2 Role of Railway in National Transport Strategy

As Uzbekistan is a large land-locked nation, the railways play an extremely important role in national transport strategy. The same hold true for the entire Central Asian Region, at whose heart Uzbekistan is situated.

After independence, the Central Asian Railways were separated from most non-Uzbek operations, and became the Uzbek Railways. They thus inherited a large technical basis, probably over-dimensioned for the reduced responsibilities.

Declining traffics eroded the revenue base, as did controlled prices which did not grow in pace with inflation. As a result little money was put into maintaining or repairing the infrastructure, leaving a significant related backlog.

The main issues facing the Government now could be summarized as follows, probably in that order:

- how to ensure that the necessary works on the railways could be carried out, ensuring that the infrastructure remains in proper condition using as little financial resources as possible?
- similarly, how to ensure that investment in rolling stock and maintenance facilities would be kept to a minimum, and typically, without support from the State budget?
- how to ensure that trains would run effectively and safely in accordance with expectations of passengers and shippers?
- how to ensure that prices charged allow the providers of services a decent return on the capital
 invested and a decent salary for their employees, while making sure that they keep being
 motivated to reduce their costs and increase their efficiency.



1.1.3 Change to market economy

Before the break-up of the Soviet Union, the railway operated in a very protected environment, with a virtual monopoly in certain types of transport, particularly long-distance freight transport.

With the coming of a market economy, the railway must compete on price and service with other modes of transport.

It is in the interest of the State to open up the railways to market competition, because this will increase efficiency, lower costs to customers and provide higher levels of service. Nevertheless, the Government will want to maintain ownership of the railway infrastructure and regulate the competitive environment, because the railway are of national strategic importance, they are energy efficient and environmentally friendly, and also provide certain socially-beneficial transport services.

While maintaining public ownership of the infrastructure and wishing to expand services, the Sate also wants to save public money. Attraction of private capital into railway service, is one way the Sate can encourage the much-needed investment, consistent with saving public money.

The change to a market economy therefore raises some conflicting interests which require resolution in a new State/Railways relationship.

1.1.4 International Experience

Most of the issues that impinge on the relationship between the State and the railway are common to other countries with market economies. Therefore, much can be learned from other countries that have struggled with the issues and derived solutions to meet the needs. The experience of Western European countries is especially relevant.

Nevertheless, there are issues that are particular to Uzbekistan, which have been taken into account in proposing a new structure for the relationship between the Government of Uzbekistan and UTY.

1.2 Policy Issues

1.2.1 Market Orientation/Railway Restructuring

UTY will increasingly face competition from other modes of transport in a free market economy. Already there is significant competition from buses and private cars for passenger traffic. This can be expected to grow with improvements in roads infrastructure, and increase in income.

Greater competition can also be expected for freight traffic.

The railway itself is restructuring to meet the challenges and opportunities of new market situation.

The State/Railway relationship must also be restructured to meet the new situation.



1.2.2 Harmonization of Competition

It is in the interests of the State to have competition in the transport sector in such a way that hidden subsidies are eliminated, and that there is a "level playing field" for the different transport modes.

This is particularly relevant as between road and rail. The costs of the road infrastructure is often hidden in central and local Government accounts, and is not recovered from the cars, buses and trucks that provide transport service. On the other hand, the costs of the railway infrastructure can be clearly identified and are charged in full to the railways.

1.2.3 Investment

Uzbekistan is a country trying hard to develop its economy and the living standard of its population. In order to achieve this, capital investment is necessary. As money is scarce it must to a certain extent come from abroad. As the experience in other parts of the world has shown, railway restructuring and streamlining can essentially reduce the financial burden on the government (and the tax payer) and set free capital that might be used to develop the railway system faster or spent for other purposes.

It would also be a relief for the Government budget if private capital could be interested in investing into some of the rail activities. Prerequisites for interesting private capital are efficiency and business profitability or at least solid prospect for it. This prospect does not exist for the moment. However, the opening up of the railway infrastructure to Third Party Access could provide opportunities for private investment in passenger and/or freight services.

1.2.4 Public Service Obligation (PSO)

The primary objective of the State should be to ensure the continuing availability of transportation services to the public at affordable prices, to be performed in a cost effective way, so as to minimize the drain on public funds, if there should be any. In this role, the State is represented by a body it appoints specially, called the "Regulator".

This PSO is typically represented by an obligation to provide adequate capacity on specific routes with specified frequency of service and quality of service.

If no competitor is willing to offer this service, the Regulator transfers this obligation onto the public operator.

Conversely, if adequate competition is available, the Regulator may transfer this obligation onto another operator, or only monitor that competitors do actually compete.

Different situations exist for commuting services on the one hand and for long-distance international services on the other hand

1.2.5 Price Controls

If no or only limited competition exists for the provision of services under a PSO, the Regulator will define the maximum level for prices the operator is allowed to charge customers.

This level typically allows the operator to cover legitimate costs; the calculation and price revision mechanisms typically ensure that the operator will be motivated to bring the quality of service and the productivity up, for instance by being allowed to retain for itself and its employees part of the economic value of the improvements achieved.

If the price level does not allow the operator to cover its costs, and it cannot be raised for social or other considerations, it is traditional practice that the State would reimburse the difference, so as to allow the operator to deliver the service.

Public service obligations (for example extremely low tariffs) are imposed on UTY in the general interest of the country but financially they are not always compensated sufficiently. This doesn't make it a priority for UTY to invest into certain services and the result can be a degrading quality and therefore, at least potentially, a decreasing quantity of transport services. In the long run such a policy can be disastrous for the railway enterprise.

1.2.6 Human Resources

Over-staffing has been a major problem of most railway all over the world. UTY is no exception of this trend. The decline in traffic since the breakup of the Soviet Union has made has made the over-staffing situation worse.

In addition the railway undertakes a range of social services (education and health care) which would normally be provided by other state authorities, and which should be divested.

These give rise to very substantial human resources challenges in the years ahead. The State wishes the railway to become efficient, which implies staff cuts; yet the State does not want to increase unemployment. The task of re-training and redeployment of excess staff will be difficult and costly. The State should subsidize the railway in this task and not allow the full financial burden to fall on UTY.

The provision of health and education services to UTY employees and their families is a very significant additional benefit, since the standard of these services is generally accepted to the higher the those available from public health and education authorities. As and when these services are diverted, it may become difficult to retain quality employees.

1.2.7 Third Party Access

As the political aim should not be to privilege UTY and maintain it in the status of rail traffic monopolist but to encourage efficient rail transport on a general basis, third parties should not only be allowed to build and operate access lines - as already happens - but to operate passenger and freight trains on the main network. There they would be in competition with UTY. They would have to pay the same user fees as the UTY Passenger and Freight Business Units and should not be discriminated in any way. The licensing of these railway enterprises should be regulated by law.



Competitive pressure, cost reduction and innovative ideas would result from this new possibility. It would be irrelevant whether the operators were state-owned or private. Own account traffic should continue to be permitted and should be further encouraged.

There are indications of interests already by private companies to provide specified passenger services, possibly in joint venture with UTY.

1.2.8 Privatization/Corporatisation

Privatization of UTY as a whole is not a option in the short-term because the Enterprise is not profitable. Even in the long term, full privatization may not become attractive due to lack of overall profitability.

However, privatization of certain Enterprises and services could be attractive in the short to medium term. Any such opportunities should be pursued to raise much-needed capital, increase competition and improve services.

Our recommendations on internal reorganization involve splitting UTY into separate, autonomous entities to improve their management. Some of these entities may further be "corporatised", creating separate legal entities. These changes would greatly facilitate subsequent privatization.

The tax laws could support or discourage corporatisation. If the tax laws do impose a financial burden on corporatisation, they should be changed.

1.3 Proposals for a new State/Railway Relationship

1.3.1 Principles for a new framework

The experience in the countries of Western Europe with a tradition of State owned companies and heavy State participation in the economic activity of the country has shown that in the long run this is not only very costly but also very often inefficient. State run Enterprises have enormous difficulties to compete with private ones in the deregulated market. That is why there should be a decisive move towards separating economic activities as strictly as possible from true Government functions such as ensuring fair competition in the market, safety control, regional development, social welfare etc.

The hierarchical subordination of the railways under the Government can lead and mostly does lead to management decisions that are not compatible with the entrepreneurial, particularly commercial, interests of the railways which will have to respond to the free transport market.

As was the case in Western European countries before the restructuring of their railways it seems that the Uzbekistan Government plays a multi-functional role vis-a-vis UTY, namely as

 the industrial supervisory authority, above all concerning the elaboration of and respect for the safety regulations;



- the requirer of services of public interests from the railway;
- the owner of the railway organization;
- the financing body of large parts of UTY's capital needs;
- the political institution getting involved in railway matters on behalf of the general interest of the country.

These five functions are carried out arbitrarily in daily administrated management. The result is a lack of transparency in the relationship between State and railways, which makes it difficult to fix business responsibility, and prevents a clear answer to question whether UTY as a whole or its individual performances are micro-economically profitable or not. It also bears the heavy risk that public money is wrongly allocated and thus wasted.

The existing relationship between State and UTY should be changed in the sense that entrepreneurial and State functions should be clearly separated and excessive involvement of the State in the business management of railways eliminated.

1.3.2 Regulation

It may be argued that some level of supervision by the State will always exist, where the State exercises following roles.

- guardian and possibly owner of the main railway facilities, considered as national strategic asset, to be kept in proper condition;
- owner of railways assets, and of shares of companies owning railways assets, which must earn a decent return on their value;
- guardian of the safety of the general public;
- guardian of the interest of the public, which needs transportation services to be available, at a fair price.

We propose that the Government of Uzbekistan will create a new position of <u>Regulator</u>. The Office of the Regulator will have a small staff with the necessary financial and technical expertise. The Regulator, on behalf of the Government, will be responsible for:

- the conditions in which the infrastructure should be build or maintained, including the financial conditions... and leave it up to a company to carry out the instructions;
- the prices and budgets, or only control them;
- · the safety standards, and control their proper enforcement;
- the so-called PSO for Public Service Obligation, to be rendered by specific operators, and control the prices charged;
- the negotiation of a Performance Agreement with UTY, and monitoring that UTY complies with the Agreement.



1.3.3 Performance Agreement

The general purposes of UTY will be defined as:

- The operation of a Railway on the Uzbekistan State railway system.
- Provision of passenger and freight services in a commercial manner.
- Regulation of the use of the railway infrastructure by other enterprises permitted to operate thereon.
- Undertaking other related and ancillary activities as determined by the Government or Board.

There will be a <u>Performance Agreement</u> agreed between the Government and UTY, which will include the following provisions:

- Period of Agreement (five years would be reasonable);
- Use of state-owned property (land, buildings, equipment, etc.) by UTY, especially land usage and development;
- Definition of what constitutes the railway infrastructure;
- General policy of Government for the period of the Agreement;
- General policy of UTY with focus on provision of passenger and freight services, renewal of infrastructure, financial management and restructuring.

The Performance Agreement will contain the following provisions:

- <u>Mission Statement</u> for UTY, to be set by the Government and agreed by the Railway.
- Strategy, which is the framework for achievement of UTY's Mission.
- Specific <u>Objectives</u>, under the Strategy in the areas of:
 - the Customer
 - Passenger Services: operations, tariffs, and marketing
 - Freight Services: marketing and operations
 - International Dimension
 - Infrastructure Renewal
 - Information Technology
 - Improvement of Management
 - Human Resources
 - Public Service Obligations and related Social Fares
 - Social Services
 - Finance, Accounting & Costing Systems
- Investment Plan
- Performance Factors
- Execution of Contract

A Sample Performance Agreement is attached as Annexe 1.



1.3.4 Restructuring Agency

A very significant and challenging task involved in the re-structuring of UTY relates to the wide range of activities which are outside the core railway business of providing safe, competitive and efficient transport services. The involvement of Railway in these non-core activities was due to public policy under the Soviet system. The railway readily undertook these other activities and carried them out very well. The standards achieved by the UTY in education and health services is considered to be superior to the standards of the public health and education authorities.

However, in the new situation of a free-market economy, these non-core activities should be divested, to allow UTY management to concentrate on serving railway customers, upgrading services, and improving performance and efficiency. Some of the non-core activities could be divested in the short term, others will take a much longer time. The process of divestment is a complex and a difficult task, calling for special skills. In order to achieve the divestment efficiently, we propose the creation of a Restructuring Agency. Non-core activities should be transferred to the Restructuring Agency, which will be responsible for divestment, and also responsible for management of the activities until such time as they can be divested.

The non-core activities to be transferred to the Restructuring Agency fall into three groups, as follows:

- <u>Social Services</u>. These include health services and educational facilities, which should be transferred to the relevant public authorities. Excess employees of UTY should also be transferred to this group for re-training and redeployment.
- Enterprises Ready For Privatization. There are some enterprises such as the Marble Works, which could be privatized in the short to medium term. All options should be considered, including joint venture or management buy-out. Surplus property and buildings should also be sold for maximum price.
- New Construction Activities. These activities should be separated from those concerned with ongoing maintenance and upgrade of infrastructure, which belong in the Infrastructure Service Unit. New construction activities would potentially be privatised or part-privatised. The Infrastructure Unit should be free to contract out new construction work to private constructors in order to get the best possible deal for UTY, to economise on the use of public funds.

The cash flows generated by divesting of non-core activities and assets can be used to finance the social costs of restructuring (e.g. re-training), or used for productive investment in core railway activities.

1.3.5 Legal Considerations

There must be corresponding amendments in the laws of Uzbekistan to ensure that there is legal support for the new relationship between the State and Uzbekiston Temir Yullari.

These legal changes are detailed in Chapter 3 « Legal Framework of Uzbekistan Railways ».



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ANNEXE 1 - DRAFT PERFORMANCE AGREEMENT





1.2 Draft Performance Agreement

1.2.1 INTRODUCTION

The Government is committed to the development of a market economy in which the Railway is seen to have a vital role. The Government is also committed to the further development of economic relations with neighbouring countries. The Railway has a major contribution to make in these areas also.

The Government requires that Railways should become more efficient not only in terms of their services but also in their financial performance. The anticipated growth in the economy with corresponding increases in wages and increased motorisation and road haulage will place considerable strain on railway finances. The Government should recognise this and be prepared to support a Business Plan including the necessary investments to improve railway performance and productivity.

Governments are generally conscious of the social role of the Railway in serving economically disadvantaged areas. They recognise the role which it can play in priming development. The Government should therefore be prepared to continue to support the railways in these areas subject to certain conditions. A contract should be drawn up between the two parties specifying both the level of the service and the price.

The Performance Agreement will operate in a framework in which the individual and the business enterprises have free choice of transport. The advantages of the railway in terms of its efficiency in the use of energy and space will be recognised as will its contribution to the improvement of the environment.

1.2.2 Mission Statement

The Railway Company will manage, maintain and develop the railways in accordance with the best commercial practice and provide a service of the highest quality with particular regard to safety, comfort and punctuality. The services will take into account the social needs of the country in accordance with the Government requirements. Links with neighbouring countries will be developed.

1.2.3 STRATEGY

It should continue to be the policy of the Government to support free choice of transport mode and to promote the harmonisation of competition between the modes.

The Railway Company will proceed with re-structuring to improve its performance. New operating concepts will be introduced including an improved passenger timetable and a rationalisation of the freight system. The international services will continue to be developed.

The requirement for social services will be dealt with by a public service contract.

1.2.4 OBJECTIVES

1.2.4.1 The Customer

The operations will be focused on customer service. Comprehensive and clear information will be made available at all times. Service standards will be maintained and improved upon on a continuing basis. Contact will be retained with representatives of the users. Liaison will be established with local Government representatives.

Customer needs will be researched and the offer tailored or adjusted to the requirement.

1.2.4.2 Marketing the Passenger Services

The Railway will pursue a dynamic policy not only to retain existing but also to win new traffic. Groups to be targeted include families, youths, tourists and special interest. Global products incorporating all aspects of travel should be developed.

The overall objective must be to increase the contribution of passenger traffic to fixed costs.

1.2.4.3 Passenger Operations

The passenger system will be reorganised giving fast, frequent and comfortable passenger services between the major centres. New rolling stock with higher performance and comfort levels will be acquired. Services on the branch lines will be matched to the demand and staff utilisation will be improved.

The international services will be reviewed with a view to upgrading and increasing numbers and contribution

1.2.4.4 Passenger Tariffs

Passenger tariffs will be increased gradually as appropriate. In time it should be possible to charge a premium over bus fares to represent the greater comfort of rail travel.

Flexibility will be introduced into the pricing structure to maximise rolling stock utilisation and market opportunities will be exploited.

1.2.4.5 Marketing the Freight Services

Freight marketing will be focused on improving the competitiveness of the railway. New services which are better adapted to meeting the needs of the customer will be developed. Comprehensive packages which correspond to the logistical requirements of different industries will be offered.

1.2.4.6 Freight Operations

The freight operations will be rationalised. The number of marshalling yards will be reduced and freight handling will be concentrated on a limited number of freight centres. The number of block trains will be increased. Individual wagon load traffic will be discouraged.

Combined Transport will be developed and the appropriate container handling equipment made available at suitable transfer locations.

1.2.4.7 The International Dimension

The Railway Company will co-operate with the neighbouring railways in order to improve the services and increase revenue. The ultimate objective will be to create fast frequent inter-city services serving the Trans-European Railway network. Consideration will be given to unified marketing and to through working of all trains. The issue of excessive frontier delays will be addressed.

1.2.4.8 Infrastructure Renewal

The infrastructure will be renewed as appropriate. The signalling will be upgraded and the telecommunications network modernised.

1.2.4.9 Information Technology

Modern computer hardware and software will be acquired and fast and reliable communications links provided. The objective will be to improve the efficiency of administration and the effectiveness of management through the availability of a comprehensive MIS system.

1.2.4.10 Improvement of Management

A new management organisation will be introduced in accordance with the best modern practice.

Training courses will be organised for all levels of staff with particular emphasis on management and business training.

1.2.4.11 Human Resources

Manpower planning will be introduced and special provisions made to deal with staff movements following on restructuring. Retraining will be organised as appropriate and arrangements for displaced staff agreed.

1.2.4.12 Social Fares

Social fares introduced by the railways at the behest of the Government will be compensated for in accordance with an agreed formula.

1.2.4.13 Social Services

The requirements for social services will be decided by the Government in consultation with the railway enterprise. A contract to cover the service requirements on the one hand and the cost on the other will be negotiated and agreed. The public service contract will cover inter-alia:

- the nature of the services to be provided including frequency, capacity and quality
- the price
- changes to the specification
- the period of validity
- · the penalties for failure to deliver

1.2.4.14 Finance

The accounting system will be altered as appropriate to bring it into line with International Accounting Standards.

A computerised MIS including Budgeting and budget reporting will be introduced.

The costing systems will be developed in a manner which is consistent with the best international practice.

Support payments from Government will be clearly set out.

1.2.5 INVESTMENT PLAN

The Government will support the Railway Company in financing an agreed investment plan over a nominated period of at least 5 years.

1.2.6 PERFORMANCE FACTORS

The investment will have the effect of reducing expenditure and of increasing revenue.

The Government for its part will expect a reduction in real expenditure which will be specified.

1.2.7 EXECUTION OF CONTRACT

The Railway Enter prise will present to the Government each year details of their performance for the previous year and projections for the current year. The extent to which they succeeded in achieving the agreed targets will be examined and assessed. Action will be taken on any adjustments or corrections necessary

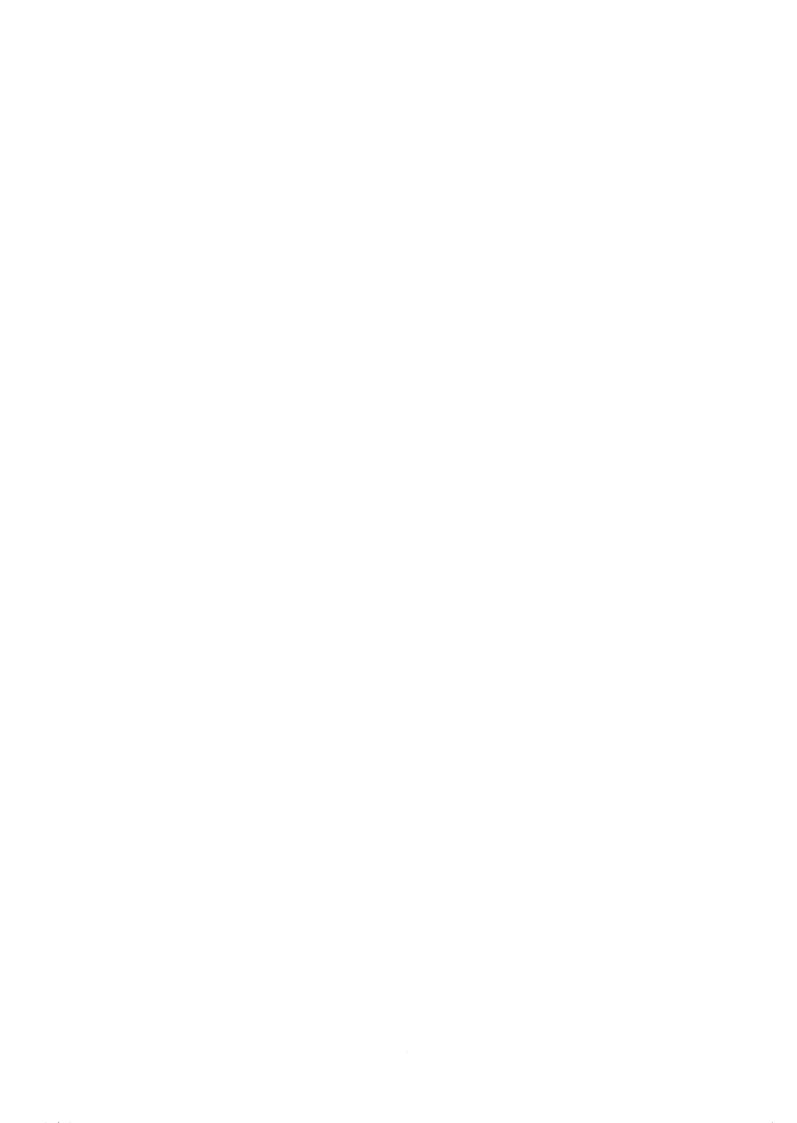


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ANNEXE 2 - RECOMMENDED ORGANIZATIONAL STRUCTURE FOR THE UZBEKISTAN

TEMIR YULLARY



2. Management reorganisation

2.1 Introduction

Uzbekistan Temir Yullary is facing formidable challenges, with a very substantial decline in traffic volumes since achieving independence. There is a great need for a greater efficiency, better customer service, a reduction in costs leading to improved financial performance and for control of investment expenditures.

International practice in Railway organisation now generally favours separate funding and accounting for infrastructure, which is seen as a public-owned national asset. There is a need for a greater commercial freedom and accountability in the provision of passenger and freight services. There is a growing trend internationally to allow third party access to national rail system. There is already limited third party access to the UTY rail system by some major freight customers. There is potential to expand third party access for freight services. There is also potential for early provision by third parties for passenger services, which could include direct competition in passenger services, high-end services added to existing UTY service offerings or specialised new tourist services.

2.2 Current UTY Organisation Options

The Government and the railway have been conscious of the need for management re-organisation, and are in the process of drafting a new management structure. The task is under the direction of the Work Group of the Government commission for Enhancement of Uzbekistan Railway Management Structure headed by Deputy Prime Minister Mr. Rakhimov. The Work Group has delegated the task to the Centre for Enhancement of Uzbekistan Railway Management Structure, headed by Mr. Kadirov.

A proposed new management structure has been tabled for consideration, see Annexe 1. The structure has been circulated to senior UTY management with requests for comment and submission of alternative options. To date, four different options have been submitted, which are being considered by the Centre for Enhancement of Uzbekistan Railway Management Structure.

We consider that the new management structure under consideration has considerable merit and goes a long way to preparing UTY to operate in the new market environment, with greater control of operating costs and investment, and improved customer service. We fully support the creation of units for provision of passenger and freight services, with profit responsibility. We fully support the creation of a separate infrastructure unit. We would consider that the traffic Management Centre whould operate more effectively as part of the infrastructure unit. We consider greater emphasis should be given to Rolling Stock major maintenance through creation of a Rolling Stock Service Unit. We consider that corporate level services would be more effectively managed by grouping them in a Corporate Service Unit. We consider that core railway business will be more effectively managed by allocating non-core activities to a new Restructuring Agency, with responsibility for (a) social services (health, education, re-training), (b) enterprises that can be privatised in the short to medium term and (c) design and construction enterprises for major projects.

2.3 Organisation Principles

Traditionally railways organised their management structures on functional principles. This involved grouping of activities according to their different functions. The functional approach has been widely applied in many types of enterprise, and has many advantages. However, a functional-type organisation structure has certain disadvantages. Functional departments can become too focused on their own speciality, losing sight of overall objectives of the enterprise. Only the Chief Executive can be held responsible for profit performance.

Most railways in other countries, which have re-organised in recent years, have moved away from a functional-type organisation structure to the creation of Separate Business Units (SBUs) within the enterprise. SBUs have their own product or service line, have their own marketing, sales and operations, with real profit responsibility. Sometime SBUs are established as separate legal corporations. SBUs develop their own missions and goals, within the framework of the corporate mission, and prepare their own strategic plans. SBU managers require the entrepreneurial skills of managers of private business. They may or may not have competition.

The proposed organisation structure will support the following objectives:

- clear accountability to the Government of Uzbekistan for the custody and operation of valuable and strategically vital national assets;
- provision of customer-focused transport services in a commercial manner in competition with other modes of transport;
- logical grouping of activities and functions to achieve efficiency and effectiveness;
- clear accountability within UTY;
- good communications internal and external:
- achievement of financial objectives;
- restructuring of non-core activities.

2.4 Proposed Organisational Structure

2.4.1 Overall structure

The proposed organisation structure is outlined in Annexe 2.

Responsibility for the operation of Uzbekistan Temir Yullary should be delegated by the Government to a **Board of Directors**, who will be appointed by the Government. The Board will have an Executive Chairman. Board Directors will include representatives of the Cabinet of Ministers, financial institutions, major customers, transport industry and the travelling public, along with some UTY top management.



The Board and all the activities of UTY will be monitored by a Regulator, who will be appointed by and responsible to the Government. The office of the Regulator will have a small staff who will be responsible for ensuring that UTY meets its Public Service Obligations, will apply economic control on the financial affairs of UTY, especially review of investment programs, monitor public safety, will negotiate the Performance Agreement with UTY and issue appropriate licences. The role of the office of the Regulator is discussed in further details in Chapter 1 on State/Railway Relationships.

The Chairman of the Board of UTY will have a small staff, responsible for Board Secretariat, public relations and UTY's safety Inspectorate. The Executive Chairman will be responsible for overall direction of in accordance with Board policy and budgets, within the framework agreed with Government on Public Service Obligations, legal requirements, safety and economic plans. The Chairman will co-ordinate the activities of the various units within UTY, monitor their performance and direct that corrective action is taken where necessary.

We propose two Business Units operating as profit centres, one for Passenger Services and the other for Freight Services. Each Unit will be responsible for its own marketing and sales, operations, staff and accounting. Each BU will carry real profit responsibility and will have control over the resources it needs to achieve efficient, customer-oriented, profitable operation. The BUs could be established as separate joint-stock companies, with the shares owned by UTY, provided that tax considerations do not impose too heavy a financial burden.

We propose an Infrastructure Service Unit, which will own the infrastructure, on behalf of the Government. The Infrastructure Unit will be responsible for track maintenance and renewals, buildings, signalling & communications, power supply and the Traffic Control Centre. It will supply and charge for services to the Passenger and Freight BUs. The Infrastructure Unit will be prepared at some future date to provide and charge for third party access to the system. The Unit will have its own human resource and accounting functions.

We propose a Rolling Stock Service Unit, which will be responsible for major maintenance and overhaul of all Rolling Stock, locomotives, freight wagons, and passenger coaches. Provision could be made for the Rolling Stock unit to own the rolling stock, which it would lease to the Passenger and Freight BUs. It would also be encouraged to provide services at a profit to third parties. The Unit will have its own human resource and accounting functions.

Even though the Business Units and the Service Units will have significant autonomy and manage most of their own functions there will still remain other functions, which can most effectively and efficiently be handled at corporate level. We therefore propose a Corporate Services Unit which will be responsible for corporate planning, treasury, central accounts, economics, central purchasing, information systems, environmental protection, central human resources, international accounts and agreements.

UTY is currently engaged in a wide range of activities that are peripheral to its core railway business. These activities should be divested to public agencies or privatised, some in the near future, others in the long term. To free up railway managers to concentrate on core business services, we propose the creation of a **Restructuring Agency**, which will take responsibility for the non-core activities. The Restructuring Agency will have three sections, one for non-commercial social activities (education, health care), the second section for commercial activities

that would be privatised in the short to medium term (marble works, sleeper plant, freight-forwarding agency, buildings/property surplus to requirements), and the third for design and construction for major projects.

The heads of the BUs, Service Units and Restructuring Agency, under the chairmanship of the Executive Chairman, will constitute the **Management Committee**, which will meet on a regular basis to co-ordinate the activities of UTY.

2.4.2 Board of Directors

Management of UTY will be delegated by the Government to the Board of UTY. The Government will appoint the Chairman and Board Directors.

The number of Directors on the Board must be large enough to ensure a good range of expertise and representation, but not so large to become cumbersome. We suggest that a good compromise would be about ten Board members, plus the Chairman. The Chairman will be a full-time executive appointment, who will be Chief Executive Officer of UTY.

The membership of the Board will be made up as follows:

- Two representatives of the Government;
- Five non-executive Directors who reflect the interests of Business/financial institutions, major UTY freight customers, the transport sector and the travelling public;
- Three executive directors who would each be the Head of one of UTY's major Units.

The responsibilities of the Board of UTY will be:

- Establish objectives and policies for UTY in harmony with Government policy, Public Service Obligation, legal requirements and the Contract Plan between the Government and UTY;
- Establish a management organisation structure for UTY, and appoint the top management team:
- Approve annual budget and targets for UTY in total, and for each of the Units;
- Monitor the progress of UTY in comparison with objectives, budgets and plans;
- Safeguard the assets of UTY:
- Protect the interests of customers and staff;
- Report to the Government on the discharge of its responsibilities.

The Chairman will have an Office with a small staff responsible for Board Secretariat, public relations, UTY safety Inspectorate and legal affairs.

2.4.3 Passenger Business Unit

The Passenger Business Unit will have its own marketing and sales operations, accounting and human resources functions. It will develop and sell passenger services on the long distance/international and commuter markets. It will operate and do minor maintenance on its own rolling stock, including locomotives. The rolling stock may be owned by the Passenger BU, or may be leased from the Rolling State Service Unit. The Passenger BU with contract with the Rolling Stock Unit for major maintenance and overhaul on rolling stock. It will contract with the Freight BU for reciprocal use of locomotives, are required to minimise operating costs.



The Passenger BU will employ and manage its own staff, including loco drivers and station personnel. It will contract with the infrastructure Unit for use of infrastructure (track, electric power supply and building). It will operate its own services under the control of the Traffic Control Centre in Infrastructure Unit.

The Passenger BU will operate as a self-contained business with profit responsibility, in collaboration with the other Units in UTY, and in harmony with overall UTY objectives and policies.

The main functions of The Passenger Business Unit will be:

- provision of cost effective and safe public passenger transport in harmony with UTY Public Service Obligation;
- development of safe attractive services for passengers to meet market needs, and which are competitive with other forms of transport;
- achievement of financial and other targets as set by Passenger BU and approved by the Board of UTY.
- management and development of staff;
- contract with Rolling Stock Unit for maintenance of rolling stock, with Infrastructure Unit for use of infrastructure, and with other suppliers for required services;

The proposed internal organisation structure is shown in Fig. , and described in greater detail in Section.

2.4.4 Freight Business Unit

Like the Passenger Business Unit the Freight Unit will also be a self-contained unit with profit responsibility. It will be structured internally with senior managers responsible for operations, marketing/sales, accounts and human resources.

The main functions of the Freight Business Unit will be:

- development and marketing of freight services to meet market needs, in competition with other forms of transport;
- transport of goods, national and international, in a safe, secure, reliable and cost-effective manner;
- achievement of financial and other targets set by Freight BU, and approved by Board of UTY.
- management and development of staff;
- contract with Rolling Stock Unit for maintenance and overhaul of rolling stock, including locomotives. (Possibly contract for lease of rolling stock, if owned by Rolling Stock Unit);
- contract with Infrastructure Unit for use of infrastructure (track, power supply, freight yards and depots);

2.4.5 Rolling Stock Service Unit

We propose the establishing of Rolling Stock Service Unit, which will carry out major maintenance and overhauls for the Passenger and Freight Business Units on locomotives, passenger carriages, and freight wagons. It will operate as an autonomous enterprise with its own technical, workshops, accounts and human resource managers. It will negotiate contracts for the supply of maintenance services to the Passenger and Freight Business Units.

The option should be kept open for the Rolling Stock Unit to own rolling stock, which it would then lease to the Passenger and Freight Units.

The Rolling Stock Unit will be encouraged to provide engineering services to third parties on a commercial basis. The diesel locomotive overhaul workshops currently carry out some major maintenance work on locos for Russian railways and get paid in a barter deal with spares. There should be potential for expansion of profitable business, especially from industrial railways and other Central Asian Railways.

The principal functions of the Rolling Stock Service Unit will include:

- major maintenance and overhaul of rolling stock, including locomotives (diesel and electric), passenger carriages and freight wagons;
- contract with Passenger and Freight Business Units, and third party customers where profitable, for major maintenance, overhaul and other engineering services;
- development of best practice methods, systems, equipment and workshops for engineering work;
- management, training and development of staff;
- achievement of financial and other targets set by Rolling Stock Unit and approved by Board of UTY.

2.4.6 Infrastructure Service Unit

We propose the establishment of an Infrastructure Service Unit which will group together all the activities and functions that are associated with the railway infrastructure. This will facilitate transparency of accounting for the infrastructure, which is to be seen as a national asset in public ownership. It will also facilitate charging Passenger and Freight BUs for the use of the infrastructure, and also for charging commercial rates to third party operators, if third party access is granted at some time in the future.

The principal functions of the Infrastructure Unit will be:

- provision of a safe, high quality track system as required by the Regulator;
- provision of a safe and efficient signaling and communication system;
- provision of a power supply system for electric traction;
- provision of buildings (stations, yards, depots) to Passenger and Freight BUs;



- maintenance and upgrade of the system in a cost-effective manner;
- management of new construction (to be carried out by UTY construction group or private constructors);
- management and development of staff;
- preparation of an infrastructure strategy and plan, to be approved by the Board of UTY;
- achievement of financial and other targets.

2.4.7 Corporate Services Unit

The Executive Chairman is responsible to the Board for the overall performance of UTY. The Chairman's prime role is the coordination of the activities of the Passenger and Freight BUs, and the Infrastructure and Rolling Stock Service Units. In this role the Chairman will be supported by a headquarters team, who will supply services that are more economic to supply centrally, or are more appropriate to the corporate level. These headquarters' services will be grouped under a Head of Corporate Services Unit.

The principal functions and services to be included in the Corporate Services Unit are the following:

- Corporate Planning which will draw together the plans of the operating units, combined with the plans of the Restructuring Agency, to ensure that the plans are in harmony with one another, and also in harmony with UTY overall objectives and plans.
- Central Accounts, which will provide accounting standards for all operating units and prepare
 consolidated accounts for UTY.
- Treasury which will liaise with Government, banks and international agencies for provision of capital, monitor capital spending and manage UTY's debt.
- Central Purchasing will handle purchasing of those items and supplies required by more than one operating unit (e.g. diesel oil) in order to get lower prices through greater buying power.
- Information Services, covering statistics and the operation of the Central Computer System.
- Environmental services, to ensure compliance throughout UTY to legal standards.
- Central Human Resources will establish policies to be followed by the operating units, and provide some personnel services, e.g. pensions, senior management training.
- International Accounts/Agreements will liaise with agencies and railway systems outside Uzbekistan.

2.4.8 Restructuring Agency

Under an earlier tradition, the Railway became heavily involved in a wide range of services and activities which are not core railway business. In the current situation, where the railway must provide market-driven services to its customer which are competitive with other modes of transport, it is vital that the railway divests itself of these non-core activities.

We propose the creation of a Restructuring Agency, to which the non-core activities will be transferred, so that they can be better managed, and then divested in the short or long term.

These non-core activities fall into three groups. The first group are social and non-commercial; divestment will be a long-term goal.

The second group are commercial or semi-commercial. Some could be divested in the very short term; others will take much longer to achieve the right conditions for divestment. Options for privatisation could include joint ventures, with UTY retaining a share-holding in partnership with private companies and individuals.

The third group are those entities within UTY concerned with major construction projects. These entities have potential for privatization in whole or in part, but they have vital long-term strategic interest to UTY. The future of this group is closely connected with the amount of investment that the Government will allocate for major new projects, such as electrification and construction of new railway lines.

The principal activities that will come under the Restructuring Agency are the following:

Social/Non-commercial

- Schools, kindergartens and other educational services. These provide highly valued services to UTY employees and their families. They should be transferred to state educational authorities when the state services are able to provide a comparable level of service.
- Hospitals, clinics. UTY should plan to always provide some level of medical service to
 employees, but at a much lower level than at present. Most health care services and facilities
 should be transferred to state health authorities when they are able to provide a comparable level
 of services.
- Excess employees of UTY should be transferred to the Restructuring Agency for re-training, followed by redeployment or outplacement.

Commercial

- The UTY-owned freight forwarding agency, Jeldorexpeditsia, creates an inherent conflict of interest situation, and should be privatized.
- The marble works, Jeldormramor, is peripheral to UTY business and should be privatized.
- The sleeper production plant, Akhangaranstroimaterialy, should be developed to the point where it can be privatized, with a contract to supply sleepers to UTY for a period not longer than 5 years.
- Water supply activities should be transferred as soon as possible to local authorities.

Related to major construction projects

- Track laying construction Trust
- Construction Trains
- Design Office "TashJelDorProject"
- Civil Works



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ANNEXE 1 - UTY PROPOSED MANAGEMENT STRUCTURE

ANNEXE 2 - RECOMMANDED ORGANIZATIONAL STRUCTURE FOR THE UZBEKISTAN TEMIR YULLARY



Figure 1

UTY PROPOSED MANAGEMENT STRUCTURE of State Joint - Stock company "Uzbekistan Railways"

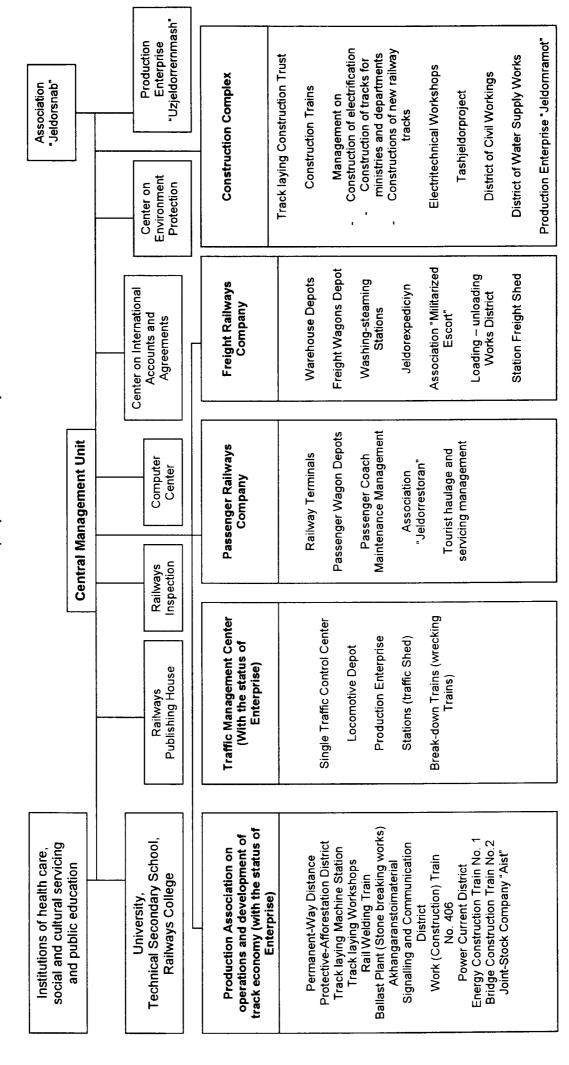


Figure 2. RECOMMENDED ORGANISATIONAL STRUCTURE FOR THE UZBEKISTAN TEMIR YULLARY

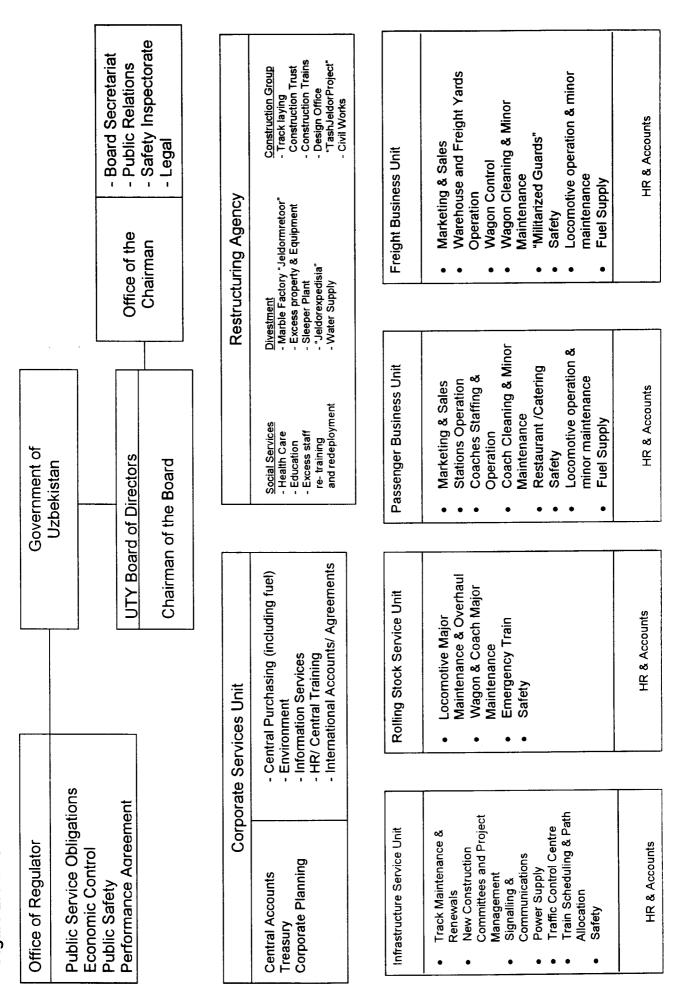


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3. Legal Framework of Uzbekistan Railways

3.1 Introduction

The main task of the legal expert is stated to be:

Examination of the legal framework and status of the Railway, its respective powers, obligations and responsibilities and its relationships to the Ministry of Transport and Communications and other Government agencies including price control and anti-monopoly authorities.

3.2 Legal Framework - Summary

3.2.1

Railways in Uzbekistan are part of the network developed by the former Soviet Union and were regulated accordingly. With independence an entirely new situation arises; based upon an examination of the legal instruments referred to below, and interviews with personnel in the railway organisation (including the head of its legal department), the developments since independence are described in outline in this report.

3.2.2

In the former USSR railways were divided into 27 separate administrations, which reported to Moscow. One of these, Central Asian Railway, was located in Uzbekistan. These railways reported to the USSR Ministry of Railways and were, in effect, subdivisions of that Ministry.

3.2.3

Following independence, the strategic State enterprises were placed under the control of the cabinet of Ministers. On the 7th. November, 1994 the President by Order (Ukaz)² stipulated that a State joint stock company for railways (to be called Uzbekiston Temir Yullari³ ("UTY") be created.

3.2.3.1

The Order declared that UTY is the authorised State agency for the State management of the railway enterprise located within the territory of Uzbekistan⁴.

Decree of the President No. 288 supra. Article 2



¹ Terms of Reference for CENTRAL ASIAN RAILWAYS RESTRUCTURING Module B

² Decree of the President No. 288 dated 7th November, 1994

³ The spelling "Uzbekiston" is correct, the Uzbek language being used.

3.2.3.2

The main goals and objectives of UTY were set out⁵:

- study of the railway transport market;
- ensure competitiveness by creating a multi-profile of services offered to customers;
- improve performance of the railway network;
- technical improvement;
- cost reduction and improvement of service quality.

3.2.3.3

The Order further declared⁶ that "the decisions of the State Joint-Stock Railway Company "Uzbekiston Temir Yullari" taken within the limits of its authority are mandatory for the ministries, departments, corporations, concerns, associations, institutions, organisations and local authorities.

3.2.4

The State joint stock company UTY was established and its Charter approved by Decree of the Cabinet of Ministers⁷.

3.2.5

The Charter of UTY re-inforces its position as a State monopoly within which all of the functions of the State in relation to railways resides.

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The Charter⁸ provides for the appointment of a Chairman and five deputies including two "First Deputies".

3.2.5.2

Management of the Company is executed by the Board of the Company¹⁰.

3.2.5.3

The Chairman of the Company is at the same time Chairman of the Board¹¹. Membership of the Board consists of 13 persons including the Chairman, his deputies, Head of the Aral Region and the Senior Safety Inspector¹².

¹² Ibid. Article 2



⁵ *Ibid*. Article 3

⁶ Ibid. Article 4

Decree of the Cabinet of Ministers No. 249 dated 3rd July, 1995

⁸ Charter of UTY, Section IV

⁹ Ibid. Article 2

¹⁰ Ibid. Article 1

¹¹ Ibid.

3.2.5.4

The candidacies of the Chairman, his deputies and members of the Board are approved by the Cabinet of Ministers¹³.

3.2.5.5

The status and functioning of the Board are regulation by provisions approved by the Chairman of the Board¹⁴.

3.2.5.6

The "exceptional competence" (largely to do with policy) of the Board is set out at some length¹⁵.

3.2.5.7

UTY has a central management body, whose structure and membership is approved by the Cabinet of Ministers¹⁶. It is headed by the Chairman¹⁷. It makes decisions on every issue of maintenance, operation, finance and other activity not related to the exceptional competence of the Board¹⁸.

3.2.5.8

Management of the transportation process within the republic and interaction with foreign railways in the sphere of transport operations are the exceptional competence of the central management body of the Company¹⁹.

3.2.5.9

The functions of the Chairman are listed at length, and are of the nature of Chief Executive; no specific reporting structure is provided.

3.2.6

The existence of a Draft Railway Code is a positive indication of recognition by the Government of the need to provide an effective legal environment for railway transportation in Uzbekistan.

3.2.7

International traffic is dealt with within the structure of the CIS Council of Railways (of which UTY is a member) and in other cases by bi-lateral agreements.

¹⁹ Ibid.



¹³ Ibid.

¹⁴ *Ibid*. Article 4

¹⁵ Ibid. Article 5

¹⁶ Ibid. Article 6

¹⁷ Ibid. Article 7

¹⁸ *Ibid*.

3.3 Monopoly and Price Control Issues.

3.3.1

Under the Law on Enterprises, the general freedom to set prices is recognised. However, Uzbekistan Temir Yullary is considered to have a monopoly in the transport sector and does not have this freedom. Instead, tariffs are regulated by a committee reporting to the Cabinet of Ministers, which committee may instruct UTY to keep its tariffs as they are notwithstanding increases in costs. In this event, UTY is entitled to compensation from the Government in respect of losses which are incurred.

3.3.2

On the 27th. December, 1996, by Law No. 54, railway transport was specifically listed as a monopoly.

3.4 The Railway Code.

3.4.1

Previous consultants submitted two drafts - for a transport law and for a railway code - which were intended for use as standard models for the central Asian countries. The response from the Chairman of UTY was as follows²⁰:

"Draft Model Law on Railway Transport

Draft Model Law on Railway Transport for TRACECA corridor countries is, in our opinion, only a Model Structyre (sic) of Law on Railway Transport which requires more detailed elaboration and adaptation to local peculiarities of railway transport development.

Draft Model Law on Transport

Draft Model Law on Transport can be used only as main provisions. Activity of individual type of transport is to be regulated by individual law taking into account special character of particular type of transport.

This Draft also requires more detailed elaboration for use in Uzbekistan and, moreover, in the presence of separate laws for each type of transport we consider to inexpedient (sic) to accept it."

It is certainly the case that local circumstances will vary, and law which is adopted must take this into account. Indeed, in order to achieve precisely the same objectives in two different jurisdictions would almost certainly require some differences of approach in each.

3.4.2

²⁰ Source: TRACECA Transport Corridor Legal and Regulatory Framework Project TELREG 9306 Comments on Draft Model Laws and Codexes, Uzbekistan

A draft railway code was in fact submitted to parliament in July, 1997. This draft could not be regarded as following the model above referred to. The intention was that the law would have been enacted in the fourth quarter of 1997, but this was deferred due to the restructuring program - a wise decision, since the law once enacted might be difficult to change, and to legislate in advance of final decisions on the nature of the restructuring might result in a contradictory situation.

3.4.3

The restructuring committee will propose amendments (which are to be expected) to the draft code when resubmitting it.

3.4.4

An examination of the July 1997 draft disclosed a number of matters requiring comment in this report. The general thrust might be described as establishing for Uzbekistan a railway of the kind which formerly existed in the USSR.

3.4.4.5

The draft code provides²¹ "The State provides regulation and control of railway transport activity, development of its material and technical basis and meets requirements within state needs."

However the State body which will discharge the functions of the State is not identified, and it appears that this is presently done on an ad-hoc basis.

The creation of a Government agency to undertake functions of this kind for the entire transport sector is being discussed; a decision has not yet been taken as to whether this will be a Ministry or Committee or otherwise. The list of items making up the agency's functions is being debated by the Cabinet of Ministers; there is no indication when this process will be concluded, except that it is regarded as an urgent matter.

(The revision of the draft Railway Code will not be concluded until after the agency is established.)

3.4.4.6

It is unclear in the draft what will be the position regarding the ownership of the railway infrastructure, and there is no definition of what constitutes the infrastructure. In discussions with the head of the legal department of UTY the intention appears to be that what would normally be regarded as the railway infrastructure will remain the property of the State; UTY as agent of the State will use and control the infrastructure.

3.4.4.7

The approach in the draft code suggests that UTY and railways in Uzbekistan are essentially one and the same. It does not deal with the concept of railway transport as a means of transport which may be provided by a multiplicity of operators in competition with one another.

3.4.4.8

²¹ Draft Law of the Republic of Uzbekistan on Railway Transport, Article 1.



Articles 7 and 8 of the draft confer upon UTY a monopoly in railway transport excluding any interference by any party. Commercial considerations are not addressed. This, paradoxically, may lead to increased State intervention in the management function, in an unstructured manner, rather than the kind of independence needed for ensuring the success of the enterprise.

3.4.4.9

Provision is made²² for Government consent at the Cabinet of Ministers level if railway lines are to be closed. This is necessary as railways form part of the national strategic transport system. However, there is no obligation to compensate the railway operator if a refusal of consent imposes additional costs.

3.4.4.10

The draft code does not prohibit access by third party operators to the railway infrastructure; however neither does it give any protection to them against abuse by UTY of its monopoly position. Also, there is no procedure for an operators licensing system based on the competence and financial resources of applicants.

3.4.4.11

Customer complaints are dealt with solely within the context of a legal structure, which leaves the customer at considerable disadvantage. Level of customer satisfaction is not perceived as a measurement of satisfactory performance of the railway function - the opposite would be the case in a commercial enterprise.

3.5 Recommendations:

3.5.1

It is recommended that the Charter of UTY should be changed to accommodate the organisational structure, accounting and reporting procedures contained in the management re-organisation proposals listed in the re-structuring study.

3.5.2

The pending enactment of a Railway Code offers a unique opportunity to establish a legal environment within which railway transport will prosper and better serve the interests of the State and the interests of its customers.

It is recommended that when revising the draft, the following issues are addressed:

3.5.2.1

The code should legislate for railway transport as a system of transport rather than as a State monopoly conferred upon UTY.

²² *Ibid.* Article 8.4



3.5.2.2

In the case of UTY it should provide that management, within the context of the performance agreement referred to below, shall be independent in the direction, management and administration of UTY and from the administrative and economic control and internal accounting of the State, and managed according to the principles which apply to commercial companies.

3.5.2.3

It should provide for a definition of what constitutes "railway infrastructure"; railway infrastructure should be owned by the State; management of the infrastructure should in future be undertaken on behalf of the State by UTY on the basis of a commercially orientated contract, to be interlinked with the performance agreement referred to below.

In this way the State will be fully informed of where money is being spent and on the physical state of the infrastructure and participate in the planning process in accordance with the objectives for railway transport.

3.5.2.4

It should require that the accounting system of UTY clearly separates infrastructure matters from other activity and that separate accounts are maintained for public service obligations thus ensuring transparency in financial matters.

Organising formally separate companies, divisions or profit centres within what is today UTY would meet this purpose.

3.5.2.5

It should facilitate the corporatisation of UTY.

3.5.2.6

It should provide that an access fee be charged in respect of each service (passenger and freight) for the use of the railway infrastructure - to be paid by all operators including UTY (into the infrastructure fund).

3.5.2.7

It should provide that UTY when offering services as operator should primarily have regard to commercial considerations.

3.5.2.8

It should provide for a system of licensing the competence of railway operators and their rolling stock, to apply to international (including state railway companies) as well as to national operators. All licensed operators should be entitled as of right to access to the railway infrastructure on non-discriminatory terms.

3.5.2.9

It should provide that the State (as opposed to UTY itself) may make regulations to provide for the public safety of railway operations.



3.5.2.10

It should define the role of the State and establish the office of Regulator (separate from UTY), with the functions of:

- entering into agreements with UTY on the maintenance and specification for development of the infrastructure and the cost and time within which this will be done;
- entering into agreements with UTY and other railway operators for the discharge of Public Service Obligations (including free and concessionary travel) on a contractual and commercial basis;
- entering into a performance agreement with UTY and monitoring compliance; in this connection
 it is believed that if UTY exchanges its monopoly for a system of ongoing performance
 agreements (with appropriate adjustments mechanisms for accommodating unforeseen
 circumstances) greater trust will be established in the relationship. For example, in the case of
 representation in CIS railway matters, the State will have confidence that its policies will be
 pursued by UTY, and UTY will have confidence that it has the support of the State when
 pursuing its objectives;
- specifying the form of accounts to be maintained by UTY and other reporting requirements;
- undertaking the function of price control, where the protection of customers in monopolistic situations is necessary;
- licensing the competence of railway operators and their rolling stock;
- supervising public safety in railway operations by establishing a railways inspectorate with right of access to inspect the railway infrastructure; the inspectorate to request where necessary the State to make regulations relating to the public safety of railway operations;
- setting terms for third party access for operating trains on the railway infrastructure generally, and ensuring that the user fees payable to the infrastructure manager are adequate and nondiscriminatory vis a vis UTY and other users.

3.5.3

It is clear that these objectives cannot all be implemented in the short term, therefore the Railway Code should make provision for transitional arrangements during the intervening period.

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The approach used in drafting should be to set a framework within which there will be flexibility that will enable the development without legal impediment of a successful railway transport system.

3.5.5

These recommendations highlight a number of important matters which should be addressed when revising the draft railway code, and are not intended to be seen as covering the other necessary matters which will be legislated for in the railway code.



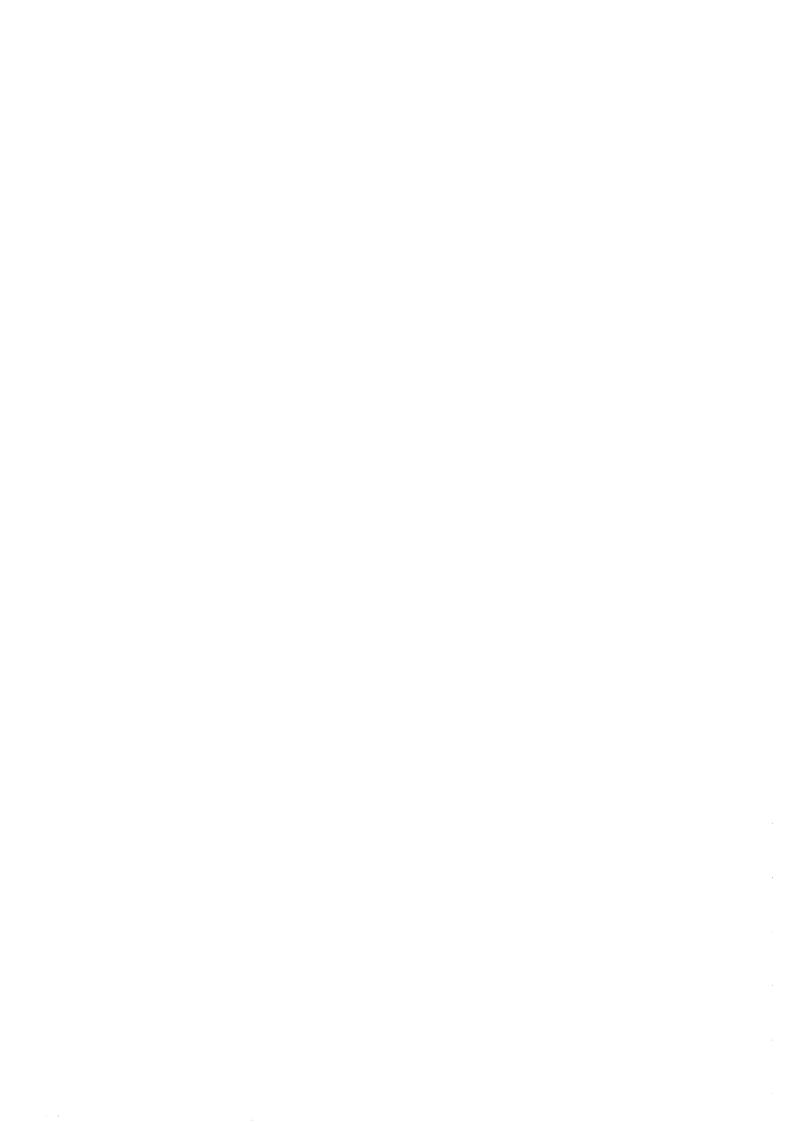
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4. Economic assessment of investments

4.1 Executive summary

The aim of this overall investment programme is to:

- support the on-going re-structuring programme
- · reduce serious shortages existing or anticipated in track facilities and rolling stock
- support the increasing effectiveness of operations
- support the modernisation of facilities to guarantee efficient and safe operation.

The investments proposed are concentrated on three major fields: infrastructure (including electrification), MIS and rolling stock.

Today the operation on UTY has to face the deterioration of the infrastructure: a significant part of the network is under speed restrictions, the average speed being below standards. Therefore the programme aims at providing UTY with standard quality materials (ballast, crossings, sleepers and bearers) in order to upgrade the lines and with the modern equipment to carry the upgrading and maintenance activities.

On rolling stock UTY is starting to face a shortage of rolling stock in adequate condition, spare parts. UTY will face high maintenance costs as soon as cannibilising would bring the existing fleet below minimum requirements, and new parts would have to be purchased. The plan is to provide UTY with the necessary equipment and spare parts to be in a position of carrying proper efficient maintenance.

Electrification is a specific topic to be dealt with. UTY is currently developing electrification projects. Works have already started on two sections, Mekhnat - Dzhizak and Djambai - Marakand, located on the "Silk Road"- Traceca Corridor. Most of the works are already finished. The remaining part hasn't been finalised by lack of hard currency to purchase imported materials. Another section in the south western area linking with Turkmenistan, is to be electrified: Marakand - Bukhara. UTY has other projects of electrification, but it has been decided to focus of these which are the most relevant today. On top of cost reductions which arise from these 3 electrification projects, are wider concerns:

- contribute to autonomy of Uzbekistan from oil imports
- develop the national high voltage grid
- and, to a lesser extent, reduce environmental impacts

Last, MIS, which will permit to improve rolling stock and infrastructure maintenance processes, as well as management processes.



The investments were split into several packages which were carefully evaluated (when relevant) on the basis of the information provided and the assumptions which had to be made.

The investment program details is shown underneath. It does specify the package number, the nature of investment, its cost (in MUSD) and the time schedule for implementation. It is based on a high borrowing capacity assumption. When considering that the borrowing capacity is limited to, roughly 150 MUSD, some of these packages are supposed to be postponed (see executive summary).

No provision for technical assistance has been included, nor for signalling and telecommunication renewal, which is to be covered by module E.

	TYPE OF INVESTMENT	COST	FIVE YEAR PROGRAMME					
			1	2	3	4	5	
	I. INFRASTRUCTURE	56.34	25.40	22.59	5.75	2.60		
PACK. 1	Track renewal	29.84	15.00	14.84		1		
PACK. 2	Structure works	2.00	2.00					
PACK. 3	Earth structure works	2.00	2.00					
PACK. 4	Improvement of concrete sleepers factory	2.00	2.00					
PACK. 5	Supply of glued insulated joints	1.00	1.00				 	
PACK. 6	Mechanisation of maintenance							
	Tamping machine	8.75		3.50	3.50	1.75	†	
	Equipment for 2 sleepers inserters gang	4.20	1.40	1.40	1.40	<u> </u>		
	Ballast cleaner	3.00	1.00	2.00			-	
	Ballast regulators	1.70		0.85	0.85	0.85		
PACK. 7	Purchase of equipment for SET	1.00	1.00					
	II ELECTRIFICATION	129.0	32.00	5.00	37.00	30.00	25.00	
PACK. 8	Mekhnat-Dzhizak	27.00	27.00					
PACK. 9	Djambai-Marakand	10.00	5.00	5.00				
PACK 10	Marakand-Bukhara	92.00			37.00	30.00	25.00	
	III. ROLLING STOCK	154.5	36.50	36.50	59.50	25.00	7.50	
PACK. 11		37.50			20.00	17.50		
PACK. 12	Upgrade loco workshop	5.00	5.00		-	-	-	
	Upgrade coach workshops and depots	5.00	5.00		-	-	-	
	Diesel locomotives depot	5.00	5.00					
	Upgrade wagon workshops and depots	10.00	5.00	5.00		-	-	
	Upgrade Uzbekistan depot	3.00	3.00					
	Spares stock	5.00	1.00	4.00	-	-	-	
PACK. 13	Freight wagons	7.50			2.50	2.50	2.50	
PACK. 14		20.00		5.00	5.00	5.00	5.00	
PACK. 15	Re-engine locomotives 2TE10	56.00	8.00	16.00	32.00			
PACK 16	IV MIS	15.50	4.50	6.50	4.25	0.25		
	TOTAL	345.3	99.40	70.59	106.5	57.85	32.50	

Two main types of investments are proposed on infrastructure:

- replacement of damaged track materials and renewal of structures
- supply of mechanised maintenance equipment

Most of the investment which fit in the first type are safety related: numerous sections have to face serious rail deterioration such as lateral wear. Risks of accidents are becoming serious. Packages N°1, 2 and 3 are in that category. Purely financial calculations which would take into account only the effect of speed restrictions on operation cost and rolling stock requirements would show that these investments are not justified. But the inclusion of the cost of potential accidents which is difficult to assess on the basis of the data provided would fully justify them.

The improvement of the sleeper factory is showing an IRR of 12.95%. It will also reinforce UTY autonomy.

The supply of glued insulated joints will reduce significantly the number of signalling defaults. When considering the number of hours lost which could be reduced, this package would be paid back immediately.

Mechanisation of maintenance is showing an IRR of 12.16%. Reduction of labour force is 40%. On top of the benefits considered is the potential increase of speed on the line. This benefit hasn't been taken into account, though it may outweigh the impact of labour reduction.

Purchase of 15 electric locomotives IRR is 30.35%. This investment should be given top priority if the electrification programme is achieved.

Re-engining of diesel locomotives is given a 26.86% IRR. Nevertheless its social costs are considerably high and the size and availability of the existing diesel fleet doesn't give this project a first priority rank. It is more advisable to concentrate on short term needs and observe the results of such changes in the neighbouring countries.

The improvement of passenger carriages would obviously not show any profitability bearing in mind that passengers transport is today a loss-maker. Sensitivity to tariffs is very high in Uzbekistan. This investment aims only at maintaining railway position on the passenger transport market and improving the operational profitability of such services.

Package 12 which includes a number of maintenance facilities upgrading and purchase of spare parts hasn't been evaluated. Such investments are justified purely by providing the railways with the necessary equipment to be able to operate.

Purchase of freight wagons wasn't evaluated; the other option to meet the anticipated need is to rent from fellow CIS countries. Current rental figures were not available, though prices were said to be "very high".

MIS will permit amongst other things to improve operation and mainly rolling stock and infrastructure maintenance. Its IRR is set at 12.8%. This however neglects the impact of the "enabling factor".

Electrification projects were evaluated separately and then globally:

- Mekhnat Dzhizak IRR is set between 10.37% and 11.40% according to the traffic scenario. Its
 benefit on operation, and in particular on the highly loaded Khavast-Dzhizak single track
 section will be positive.
- Djambai Marakand is showing a good IRR which reach between 19.54% and 16.79% according to traffic scenarios.
- Marakand Bukhara IRR, on the same basis is comprised between 7.17% and 9.29%. Nevertheless, due to the significant increase of the electrified network, electric locomotive utilisation should be, in that case, increased by 20%. Based on this assumption, the IRR would be included between 8.54% and 11.09%. A depot for electric locomotive was included fully in the investments required for the electrification of that section: though it was required for operation purposes if that section was electrified, it would have a positive impact on the operation of electric trains on the previous section. These benefits were not taken into account. The Consultant considers also that the section Marakand Navoi which is probably more loaded (UTY didn't have traffic figures split by sub-section), the IRR is potentially better on this specific section.
- The overall programme IRR is evaluated to be between 10.32% and 13.20%.

Some simplification were to be made on these evaluation: they mainly concern operations. A fully detailed operating programme should be produced to evaluate exactly the benefits of the electrification programme.

The details of calculations are shown in annex (on basic hypothesis, e.g.: maintenance cost of 0.96 USD/km, investment costs according to consultant estimates and average distance covered by an electric locomotive 159.614 km/annum¹).

4.2 Introduction

The track renewal programme of UTY has been delayed for several reasons:

- lack of hard currency to purchase imported items
- use of part of local materials for the construction of new lines.

Therefore the infrastructure has deteriorated leading the average speed on the network to reduce during the last years, the number of speed restrictions having increased significantly (about two/third of the total network). The majority of speed restrictions are regulatory. The other causes are related to the deterioration of infrastructure such as: earth and civil structures, levelling, sleepers, switches, etc...

¹ For the global project, average distance per annum = 200.00 km



The expected increase of traffic within the next years (in both optimistic and pessimistic scenarios) shows a need for operational improvement and purchase of traction units. In order to answer to these needs, two sets of solutions were then produced:

- improvement of the railway performance by upgrading the infrastructure, through removal of speed restrictions and improvement of the overall speed,
- improvement of UTY traction fleet, through upgrading of maintenance facilities, purchase of new locomotives and wagons and re-engining of some units,
- improvement of maintenance through MIS investments.

Very much emphasis was put on guaranteeing safety on the network.

The main impact expected is to allow UTY to meet goods and passenger transportation demand with the most adapted investments and to reduce its costs.

4.3 Method for project evaluation

4.3.1 Definitions

With the objective of making sure that this report will be fully understandable, we would like to define precisely the "main technical" vocabulary which is used here:

Cash flow: it is resulting from the difference between revenues and costs

Financial Internal Rate of Return: it corresponds to the maximum rate at which the company (UTY) remunerates and reimburses capital investments used to reimburse the project, preventing the project from having a negative impact on the financial result. It corresponds to the discount rate for which the net present value of the project's returns equal total project cost.

Economic Internal Rate of Return: it is based on the financial cash flow from which are deducted variations in subsidies and to which are added the economic benefits (such as time savings, reduction of accidents or job creation).

Residual Value corresponds to the value after depreciation of the investment on the last year of the concerned period.

Pay out time corresponds to the time by which the investment will be paid back.

4.3.2 Description

The method used to calculate the internal rate of return of each investment package is the conventional one:

1. definition of the present situation and evolution within the period concerned (this will be called base case)



- 2. definition of the project situation (called project case)
- 3. comparison between base case and project case in terms of revenues, maintenance cost, operation cost and investment or replacement needs.
- 4. calculation of the differential financial cash flow year by year
- 5. calculation of the internal rate of return

The cost-benefit analysis compares the value in monetary terms of all the significant positive and negative financial effects of each scenario. Costs mainly consist in the investment costs for the upgrade of railways facilities and their maintenance. Benefits (or cost reductions) include savings in staff expenses due to increase in productivity and therefore staff reduction as well as savings in other operating costs such as energy, materials and spare parts.

Railway investments typically provide a stream of costs and benefits over a long time. It is therefore necessary to have a method for comparing and combining costs and benefits incurred at different times. The underlying principle is that benefits and costs incurred today are worth more than the same quantities incurred in the future, and the further into the future they are, the less they are worth. This is not because of inflation, since the whole calculation is carried out a constant prices, but represents the real economic phenomenon that resources today are preferred to resources in the future.

The way in which the lower value of future costs and benefits is incorporated in the cost-benefit analysis is by discounting. A sum of money S in year 1 is valued in year 0 as S/(1+r), where r is the discount rate. A stream of sums, S_i in years 1, 2, ..., i is valued in year 0 as:

$$\sum S_i/(1+r)^i$$

The discounted value in year 0, or more generally in any base year, of a stream of benefits over time is the present value (PV) of the stream, and the discounted value of a stream of benefits less costs is the net present value (NPV) of the stream. The value of the discount rate which sets the NPV to 0 is the internal rate of return (IRR).

The choice of the discount rate, r, is important. The value of the discount rate used in this costbenefit analysis is 8 % (r = 0.08). This is to be consistent with the similar analysis carried out for the other TRACECA railways based on a 8 % discount rate and to enable comparison between investment plans in different countries.

In terms of valued effects, the economic outcome of a cost-benefit analysis is summed up in the NPV of a scheme, which is the present value of the difference between the benefits and the costs. If the NPV of a scheme is positive and therefore the IRR superior to the discount rate, then its benefits exceed its costs, and the project is therefore worthwhile. In the case of mutually exclusive schemes, one would want the one with the highest NPV. This is a form of optimisation. Finally, if there is a cost budget constraint, it is optimal to adopt the scheme with the highest ratio NPV/cost, until the budget is exhausted.

The costs and benefits of the different scenarios are based on data provided by the technical experts in railway infrastructure, rolling stock and MIS. For justification of these data, the reader can refer to the relevant technical reports.

In most cases, it is not possible to isolate and estimate the costs and benefits of a specific investment as it is closely connected to other investments. In such cases, the investments are put together in the same package and evaluated in the cost-benefit analysis as a whole.

The cost-benefit analysis have been carried out with different discounting periods depending on the type of investment due their differences in life span and breakdown of costs and benefits over the time.

Only monetary costs and benefits to UTY have been taken into account in this cost-benefit analysis. Monetary costs and benefits to other economic actors including the public authorities and the passengers and freight forwarders have not been included.

Due to the lack of data on sensitivity of passenger and freight demand with respect to travel time, value of time and statistics on accidents and value of life and limb, it was not possible to attach a monetary value to the increase in passenger and freight demand, the passenger time savings and the reduction in accidents. As a result, these economic benefits are not included in the cost-benefits analysis.

This however does not bias the results significantly. The proposed investment plan is not expected to generate significant additional traffic on its own. In addition, time savings are relatively marginal and the value of time of passengers and freight is low in Uzbekistan. Finally, the reduction in accidents, mainly derailments, may generate some benefits but nevertheless marginal compared to the total costs and benefits of the proposed investment plan.

As a result, the NPVs and IRRs produced in this report are likely to be rather conservative.

On some specific investments no IRR was produced. Their main benefits is to guarantee the safety of the operation and redact to the strict minimum the risk for accidents which are serious on some sections.

Some other investments were difficult to evaluate due to the impossibility to get reliable information: it is the case for the purchase of wagons and rolling stock maintenance upgrading.

4.3.3 Base case

The first step is to define what is the present situation and to assess its possible evolution. The base case (also called S0 in the tables produced for financial evaluation) considers that things remain unchanged: practices remain the same and the projections on this existing situation are based on the assumption that the railways are managed in such a way that its performance isn't improving nor deteriorating anymore. It is also called reference scenario.



In some specific cases it may be felt that the base case should be understood as a "do-nothing" situation, where the minimum level of investments is reached as long as operation isn't stopped.

The base case is based on the data which has been collected and reviewed by the technical experts. It may happen that, due to a lack of information or to unclear data provided by the railways, some data may be drawn on the basis of internationally accepted ratios. This would then be specified.

Then a cash flow is calculated, year by year. On the last year, the residual value of the investments included is added to the cash flow.

4.3.4 The project case

The project case (also called S1 in the tables produced for financial evaluation) will be based on the expected evolution of UTY with the cost and benefits of the proposed investment. These costs and benefits are based on technical specialists assumptions and phased over the years. In the evaluation produced for UTY, most of the benefits are, in fact, cost reductions.

It may be difficult, in some cases, to estimate the specific benefit of several separated investments, as these are very much linked together. Therefore several investments were put together in the same package. We could mention for example the improvement of ballast quarries, the purchase of ballast wagons and the mechanised equipment for ballast.

In order to evaluate each proposed investment, differential balance sheet for each identified project package has been set: this method compares the cash flow obtained in two scenarios, the base case and project case.

Financial evaluation is carried on a 20 year period (unless specified) in order to take into account longer term effects and life duration of the proposed investments.

A financial internal rate of return is produced as long as the pay-out time is longer than a year.

All figures are expressed into dollars at a rate of 1USD=77 SUMS.

4.4 Hypothesis

4.4.1 Revenues and traffic

We have considered in all infrastructure cases that traffic demand will not be affected by any improvement. Both pessimistic and optimistic scenarios (when necessary) were considered for all evaluations in order to assess the sensitivity to traffic levels.



The potential demand of traffic and corresponding revenues are expressed underneath:

Table no 1: Forecasts by commodity (in million tons/km) for the pessimistic scenario

Commodity I	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal	507	506	519	792	1 053	1 029	1006	982	958	946	946	946
Coke	16	16	17	22	26	26	26	26	25	25	26	26
Petroleum	7311	6 816	6 506	6 826	7 094	6 962	6 828	6 694	6 559	6 503	6 529	6 555
Ores	392	375	371	384	396	398	400	402	402	408	416	424
Black metals	414	409	416	418	419	416	413	409	405	406	416	427
Timber	174	166	167	170	174	179	181	183	185	189	195	201
Const. mat.	4 015	3 833	3 846	3 9 1 4	4 020	4 126	4 172	4 216	4 259	4 354	4 506	4 641
Fertilisers	1 076	1 098	1 149	1 274	1392	1453	1 510	1 562	1611	1676	1 820	1 964
Grain	1544	1506	1 512	1 536	1 558	1729	1890	2 042	2 184	2 346	2 440	2 533
Cotton	292	300	315	315	314	308	302	296	289	287	289	291
Other	1798	1682	1654	1650	1 660	1 670	1 655	1 639	1 623	1 625	1 649	1 664
Total	17 539	16 708	16 472	17 300	18 106	18 296	18 382	18 450	18 500	18 765	19 231	19 673

Table n° 2: Forecasts by commodity (in million tons/km) for the optimistic scenario

Commodity	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal	507	506	519	792	1 053	1 029	1 006	982	958	946	946	946
Coke	16	16	17	22	26	26	26	26	25	25	26	26
Petroleum	7311	7 027	6 9 1 5	7 480	8 013	8 107	8 198	8 285	8 368	8 554	8 854	9 164
Ores	392	375	371	384	396	398	400	402	402	408	416	424
Black metals	414	409	416	418	419	416	413	409	405	406	416	427
limber	174	166	167	170	174	179	181	183	185	189	195	201
Const. mat.	4 015	3 833	3 846	3 914	4 020	4 126	4 172	4 216	4 259	4 354	4 506	4 641
ertilisers	1 076	1 098	1 149	1 274	1 392	1 453	1 510	1 562	1 611	1 676	1 820	1 964
Grain	1 544	1 506	1 512	1 536	1 558	1 729	1 890	2 042	2 184	2 346	2 440	2 533
Cotton	292	300	315	315	314	308	302	296	289	287	289	291
Other	1 798	1 682	1 654	1 650	1 660	1 670	1 655	1 639	1 623	1 625	1 649	1 664
Total	17 539	16 919	16 881	17 953	19 025	19 441	19 751	20 041	20 309	20 816	21 556	22 281

Revenues are calculated on the basis of tons-km tariffs and forecasts for the pessimistic scenario

TPE OF			25. 3.4.	250 m	145	REVENUES	IN MSUN	1				
COMMODITY	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal	331	320	10 1319	472	609	<i>577</i>	547	518	490	470	456	442
Coke	11	11	11	14	16	15	15	14	14	13	13	13
Petroleum products	8722	8 132	7.762	8 144	8 463	8 305	8 146	7 986	7 824	7 758	7 789	7 820
Ores	179	166	159	160	160	156	152	148	144	142	140	139
Black metals	187	179	177	172	168	161	155	149	143	139	139	138
Timber	93	86	84	83	82	82	80	79	77	77	77	77
Construction materials	1208	1 119	1.089	1 075		1066	1 046	1 025	1'004"	996	1 000	999
Fertilisers	514	509	517	555	589	596	601	603	603	609	641	671
Grain	1 054	997	971	957	942	1 014	1 075	1 126	1 169	1 218	1 228	1 237
Others (inc.cotton)	1 614	1 484	1 430	1 382	1 347	1 308	1 255	1 203	1 152	1 117	1 098	1 074
TOTAL	13 913	13 003	12 517	13 014	13 445	13 281	13 072	12 851	12 621	12 538	12 580	12 608

Revenues are calculated on the basis of tons-km tariffs and forecasts for the optimistic scenario

					REVENUE	S IN MISUM						
1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2008	2007	_
331	330	339	- 517	687	672	656	641	626	618	618	618	į
11	11	11	15	18	18	18	18	17	17	18	-	
	8 383	8 249	8 923	9 559°	9 671	9 780	9 884	9 983	10 205	10 562	10 932	!
	171	169	175	181	182	183	183	184	186	190	194	
	185	188	* * 189 E	189	188	186	185	183	183	188	193	. 1
		Tana and the	Karak Maria	93		97	98	99	101	104	108	
			-	1 209	1'241	1 255	1 269	1 281	1 310	1 356	1 396	
				a real	694	721	746	769	301	869	938	
-					1*180	1 290	1 394	1 491	1 602	1 565	1 729	
		.2.4	Service - Tarre	Lande 1		1 511	1 494	1 477	1 477	1 496	1 510	
	13 406		14 262	15 191				15 110	16 499	17 067	17 636	_
	331	331 330 11 11 8 722 8 383 179 171 187 185 93 89 1 208 1 153 514 525 1 054 1 028 1 614 1 531	331 330 339- 11 11 11 8 722 8 383 8 249- 179 171 169 187 185 188 93 89 89 1 208 1 153 157 514 525 549 1 054 1 028 1 032- 1 614 1 531 1 521	331 330 339 517 11 11 11 15 8 722 8 383 8 249 8 923 179 171 169 175 187 185 188 189 93 89 89 91 1 208 1 153 1 157 1 178 514 525 549 608 1 054 1 028 1 032 1 049 1 614 1 531 1 521 1 517	331 330 339 517 687 11 11 11 15 18 8 722 8 383 8 249 8 923 9 559 179 171 169 175 181 187 185 189 189 189 93 89 91 93 1 208 1 153 1 157 1 178 1 209 514 525 549 608 665 1 054 1 028 1 032 1 049 1 064 1 614 1 531 1 521 1 517 1 524	1996 1997 1998 1999 2000 2001 331 330 339 517 687 672 11 11 11 15 18 18 8 722 8 383 8 249 8 923 9 559 9 671 179 171 169 175 181 182 187 185 188 189 189 189 93 89 91 93 96 1 208 1 153 1 157 1 1778 1 209 1 241 514 525 549 608 665 694 1 054 1 028 1 032 1 049 1 054 1 180 1 614 1 531 1 521 1 517 1 524 1 527	1996 1997 1998 1999 2000 2001 2002 331 330 339 517 687 672 656 11 11 11 15 18 18 18 8 722 8 383 8 249 8 923 9 559 9 671 9 780 179 171 169 175 181 182 183 187 185 188 189 188 186 93 89 91 93 96 97 1 208 1 153 1 157 1 178 1 209 1 241 1 255 514 525 549 608 665 694 721 1 054 1 028 1 032 1 049 1 064 1 180 1 290 1 614 1 531 1 521 1 517 1 524 1 527 1 511	1998 1997 1988 1999 2000 2001 2002 2003 331 330 339 517 687 672 656 641 111 11 11 15 183 183 183 183 183 183 183 183 185 186	1998 1997 1998 1999 2000 2001 2002 2003 2004 331 330 339 517 687 672 656 641 626 111 11 11 15 18 18 18 18 18 17 8 722 8 383 8 249 8 923 9 559 9 671 9 780 9 884 9 983 179 171 169 175 181 182 183 183 184 187 185 1881 189 189 189 189 189 188 186 185 183 93 89 91 93 96 97 98 99 1 208 1 153 1 157 1 1778 1 209 1 241 1 255 1 269 1 281 514 525 549 608 665 694 721 746 769 1 054 1 028 1 028	331 330 339 517 687 672 656 641 626 618 11 11 11 15 18 18 18 18 17 17 8 722 8 383 8 249 8 923 9 559 9 671 9 780 9 884 9 983 10 205 179 171 169 175 181 182 183 183 184 186 187 185 188 189 188 196 185 183 183 93 89 89 91 93 96 97 98 99 101 1 208 1 153 1 157 1 178 1 209 1 241 1 255 1 269 1 281 1 310 514 525 549 608 665 694 721 746 769 301 1 054 1 028 1 032 1 049 1 180 1 290 1 394 1 491 1 602<	1998 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 331 330 339 517 687 672 656 641 626 618 618 11 11 11 15 18 18 18 17 17 18 8 722 8 383 8 249 8 923 9 559 9 671 9 780 9 884 9 983 10 205 10 562 179 171 169 175 181 182 183 183 184 186 190 187 185 1881 189 189 189 189 189 188 186 185 183 183 188 93 89 91 93 96 97 98 99 101 104 1 208 1 153 1 157 1 178 1 209 1 241 1 255 1 269 1 281 1 310 1 35	1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 331 330 339 517 687 672 656 641 626 618 618 618 11 11 11 15 18 18 18 17 17 18 18 8 722 8 383 8 249 8 923 9 559 9 671 9 780 9 884 9 983 10 205 10 562 10 932 179 171 169 175 181 182 183 183 184 186 190 194 187 185 189 189 188 186 185 183 183 183 183 183 183 183 188 193 99 101 104 108 108 193 96 97 98 99 101 104 108 108 118 125

These tables were based on the following cost/revenue analysis by tonne-km and passenger-km (in 1996):

In 1996 the average revenue was:

by tonne-km 0.747 Sums
by passenger-km 0.686 Sums

4.4.2 Staff costs

The present figures on staff costs are:

Yearly average employee cost (incl.social charges) 110	0 USD

On base cases it has been assumed that employee cost will not increase. On project cases, it is assumed that it is around 3% up to 2002. Based on this assumption the cost of an employee per year in 2007 would be:

Base case 1100 USDProject case 1238 USD

The incentive to be given to employees for voluntary leaving is assumed to be a 1 year salary.

4.4.3 Locomotive inventory

Today UTY has reached its capacity in terms of traction. Any further need for rolling stock, if operational performance isn't improving, would have to be covered through investment.

4.4.3.1 Locomotives

The age profile of the locomotives is as follows:

EXISTING RS

ITEMS	N°	30-26	25-21	20-16	15-11	10-6	5-0
DIESEL	479						
2TE10P	53		29	24			
2TE10M	176				103	70	3
3TE10M	121				99	22	
2TE10V	81			77	4		
2TE116	48			31	17		
ELECTRIC	84						
VL60	28	28					
2VL60K	21	21					
VL80S	1				1		
3VL80S	34					34	
TOTAL	563	49	29	132	224	126	3

4.4.4 Life duration of materials

In order to calculate the residual value of each investment required or proposed, the following hypothesis for amortisation were taken:

ITEM	SERVICE LIFE CONSIDERED
Timber sleeper	10
Concrete sleeper	40
Diesel locos	25
Electric loco	30
Wagons	35
Coaches	30
Signals	40
Telecommunications	50
Machine tools	40
Hand tools	10
Handling equipment	20
Track maintenance equipment	20
Tools	10

The differences between standard and considered life span is explained underneath:

- Timber sleepers: the quality of timber sleeper in UTY is below standards.
- Concrete sleepers: the present level of traffic and the climate of Uzbekistan (fairly dry) where the level of corrosion is lower than in west European countries, a concrete sleeper last longer.

4.5 Infrastructure

4.5.1 Track renewal, Earth structure work and Civil engineering work

4.5.1.1 Brief description

The most serious infrastructure defects will be addressed in this package. Today UTY is facing serious risks of accidents. 1996 figures shows that 209 accidents did happen. Nevertheless according to the figures given by UTY it is difficult to assess the cost of such accidents. About two thirds of the main lines are under speed restrictions, for regulatory reasons and observed defects. The objective is to get rid of all speed restrictions on the main line, "the Silk Route", which are caused by observed defects: 50% of train derailments are due to the condition of rails. The programme includes 75 km of track renewal plus several civil and earth structures. The cost and schedule is shown underneath:

PACK N°	ITEM	Tot.	YI	Y2	Y3	Y4	Y5
PACK. 1	Track renewal	29.84	15.00	14.84			
PACK. 2	Structure works	2.00	2.00				
PACK. 3	Earth structure works	2.00	2.00				

4.5.2 Improvement of sleepers factory

4.5.2.1 Brief description

The investment concerning the improvement of the sleeper factory will allow to produce on site around 10,000 concrete bearers instead of importing them. It will also permit the improvement of the quality of concrete sleepers.

The cost and schedule is shown underneath:

Year	Total	1	2	3	4	5
Improvement of sleepers factory	2.00	2.00				
Total	2.00	2.00	0.00	0.00	0.00	0.00

4.5.2.2 Base case

No concrete bearers are being produced today in Uzbekistan. Two base cases were to be considered:

- Timber bearers are replaced in due time by new timber bearers
- Timber bearers are replaced in due time by new imported concrete bearers.

For sleepers concrete sleepers life duration is set at 40 years.

The first solution would not reduced significantly the maintenance cost. Therefore the second solution, for the base case, was taken.

4.5.2.3 Project case

The main impact of the improvement of the sleeper factory will be to reinforce UTY autonomy. This will also allow for a reduced cost of the bearers (from 100 USD for an imported bearer down to 80 USD for an Uzbek bearer). The production of 10,000 bearers would be enough to cope with UTY needs.

The existing design of the concrete sleepers now produced in Uzbekistan should be changed: the current design uses excessive material and does not provide sufficient stability in the track structure. The recommended design would generally follow the European Standard design and would improve the stability of the sleeper in the track against lateral movement. The outputs would be increased by 20,000 units through rationalisation of management and production of the factory. The IRR is estimated at 12,95 %.

araa a	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	TOTAL
SECASE: SO ports of bearers ported corrorate skeepers shiflow sidual value	1,00 0,62 -1,62 0,81	1,00 0,62 -1,62 0,86	1,00 0,62 -1,62 0,89	1,00 0,62 -1,62 0,93	1,00 0,62 -1,62 0,97	1,00 0,62 -1,62 1,01	1,00 0,62 -1,62 1,05	1,00 0,62 -1,62 1,09	1,00 0,62 -1,62 1,13	1,00 0,62 -1,62 1,17	1,00 0,62 -1,62 1,22	1,00 0,62 -1,62 1,26	1,00 0,62 -1,62 1,30	1,00 0,62 -1,62 1,34	1,00 0,62 -1,62 1,38	1,00 0,62 -1,62 1,42	1,00 0,62 -1,62 1,46	1,00 0,62 -1,62 1,50	1,00 0,62 -1,62 1,54	1,00 0,62 -1,62 1,58	1,00 0,62 23,90 1,62	-8,51 25,52
OLECT CASE: S1 in bearers production morete sleepers vestement in sl. factory shiflow sidual value	0.80 0.52 2.00 -3.32 0.66	0,80 0,52 -1,32 0,69	0,80 0,52 -1,32 0,73	0,80 0,52 -1,32 0,76	0,80 0,52 -1,32 0,79	0,80 0,52 -1,32 0,83	0.80 0.52 -1,32 0.86	0,80 0,52 -1,32 0,89	0,80 0,52 -1,32 0,92	0,80 0,52 -1,32 0,96	0,80 0,52 -1,32 0,99	0,80 0,52 -1,32 1,02	0,80 0,52 -1,32 1,06	0,80 0,52 -1,32 1,09	0,80 0,52 -1,32 1,12	0,80 0,52 -1,32 1,16	0,80 0,52 -1,32 1,19	0,80 0,52 -1,32 1,22	0,80 0,52 -1,32 1,25	0,80 0,52 -1,32 1,29	0,80 0,52 19,47 1,32	-8,93 20,79
-\$0 R	-1,70 1298%	, d30	0,30	0,30	0,30	0,30	0,30	0 30	030	0'30	ď30	d 30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	0,30	-44 3	

Pay-out time is approximately seven years.

4.5.3 Supply of glued insulated joints

4.5.3.1 Brief description

The supply of glued insulated joints will permit the reduction of signalling incidents by 2/3. The cost and schedule is shown underneath:

Year	Total	1	2	3	4	5
Supply of GIJ	1.00	1.00				

4.5.3.2 Base case

Signalling incidents are caused amongst other things by insulating faults. In 1996, 2158 have been accounted for. This amount is supposed to remain at the same level.

4.5.3.3 Project case

Purchase and installation of glued insulated joints should permit to reduce the number of signalling incidents down to 700 per year, reducing thus the number of wasted time by 4300 hours. Considering that today a locomotive runs less than this amount, it will allow to reduce the need for locomotive by one and improve wagon utilisation. Considering a cost of 3MUSD for a locomotive, the investment will be paid back right on the first year.



4.5.4 Mechanisation of maintenance

4.5.4.1 Brief description

This last package on infrastructure includes the purchase of equipment aiming at mechanising the maintenance.

Investments related to mechanisation of maintenance

Year	Total	1	2	3	4	5
Mechanise track maintenance:				-	<u> </u>	
5 Tamping/Lining machines	8.75		3.50	3.50	1.75	
Equip 3 sleeper inserting gangs	4.20	1.40	1.40	1.40		
Purchase ballast cleaning machine	3.00	1.00	2.00			
Purchase 3 ballast regulators	2.55		0.85	0.85	0.85	
Total	15.90	2.50	7.75	5.75	2.60	0.00

4.5.4.2 Base case

Things are considered to remain the same:

- the level of track maintenance staff is kept unchanged,
- operating performance and rolling stock fleet will be kept at the same level
- · employees cost is not increasing.

4.5.4.3 Project case

The mechanisation of maintenance will first allow to upgrade the overall standard of the line.

The other major impact of the project is to reduce the staff dedicated to track maintenance. The present staff number amounts to 8,637 people. It is believed that this figure could be cut by approximately 40% within a five year program (3000 people). Leaving incentive corresponding to a one year office will be paid to 2000 staff.

The IRR is 12.16%.

Basecase: SO	1999	2000	2001	2002	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	2010	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	2017	<u>2018</u>	<u>2019</u>	TODAL
Maintenance staff cos Total	9.50 -9.50	-,		9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50		9,50 -9,50	9.50 -9.50	9,50 -9,50	9,50 -9,50	9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50	9.50 -9.50	950	-100.01
Project case: S1												-,	-,	0.00	0.00	5.55	5,00	3.33	-4,50	-3.30	-2.20	
Mantenance staff cos Leawing bonus	8.81	8,16 0,57	7,57 0,58	7.02 0.60	7,02 0,62	7.02	7.02	7,02	7,02	7,02	7,02	7,02	7.02	7.02	7,02	7,02	7.02	702	7.02	702	702	
Investment Total	250 -1131	7.75 - 16.48	5,75 -13.90	260 -10 <i>2</i> 2	0,00 -7,63	0,00 -7,02	000 -7.02	0,00 -7,02	0.00 -7.02	0,00 -7,02	0.00 -7.02	0.00 -7.02	0,00 -7,02	0,00 -7.02	0,00 -7,02	0,00 -7,02	0.00 -7.02	a.00	0.00	0.00	0.00	
Resolal value	0.30		0.58		.,		-7,02	-1,02	-7,02	-7,02	-7.02	-7,02	-1,02	-7,02	-7.02	-7,02	-7,02	-702	-7.02	-7.02	-7 0 2	-171.79 1.85
S1- S 0	-1.81	-6,98	-4,40	-0.72	1,87	248	2,48	2.48	2,48	2,48	248	2.48	248	2.48	248	248	2,48	248	248	248	248	27.72
IRR	12,16%																					

Pay-out time is around 10 years.

This simulation is taking into account differential staff wages increase with and without restructuring.



4.5.5 Signalling and telecommunications

4.5.5.1 Brief description

This investment covers spare parts, tooling and instrumentation must be made available as fast as possible to ensure proper maintenance for all installations,

The cost is estimated at 2 million USD and the investment would be achieved within a 2 years period.

Year	Total	1	2	3	4	5
Purchase of equipment for SET	1.00	1.00			-	-

Possible recommendations to be produced on module E were not included.

4.5.5.2 Base case

The base considers that the existing number of hours wasted due to signalling and telecommunications incidents will remain set at the present level (2158 incidents with as an average 3 hours wasted).

Staff level will be kept at 1790.

4.5.5.3 Project case

There has been, as an average, a total of 6500 hours of delay due to signalling incidents. Through the investment and restructuring proposed the impact of the incidents would be reduced by three times (down to 2300 hours). The reduction of such incidents will marginally reduce labour operation costs. The impact on rolling stock needs isn't marginal when considering that it does represent approximately 2/3 of a locomotive and set of train.

The maintenance staff would be reduced by 650 people out of 3290. We have taken into account an average yearly salary of 1100 USD including social charges, a wage increase of 3% up to 2002 and incentives for 500 staff on voluntary leave.

The IRR is 33.93 %.

1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 3 Base case : SO	<u>-42.90</u>
Base case : SO	42.90
	42.00
Maintenance cost 3,90 3,90 3,90 3,90 3,90 3,90 3,90 3,90	42 90
Total -3,90 -3,90 -3,90 -3,90 -3,90 -3,90 -3,90 -3,90 -3,90 -3,90 -3.90	-42,50
Project case : S1	
Maintenance cost 3,62 3,35 3,45 3,56 3,56 3,56 3,56 3,56 3,56 3,56 3,5	
Leaving bonus 0,26 0,27	
Investment in SET 1,00	
Total -4,87 -3,62 -3,45 -3,56 -3,56 -3,56 -3,56 -3,56 -3,56 -3,56	-40,39
S1-S0 -0,97 0,28 0,45 0,34 0,34 0,34 0,34 0,34 0,34 0.34 0.34	2,51
IRR 33.93%	

Pay-out time is 4 years.



Faulty signalling and telecommunications installations may incur several accidents which are not included in the evaluation. Reduction of repairing times will also increase marginally the rolling stock rotation.

4.6 Rolling stock

4.6.1 Background

UTY traction fleet is quite numerous and its age is not too old, most of the fleet having reached half its theoretical life. The shortage to be expected is:

- for electric traction: within two years the existing fleet will be halved.
- for diesel traction the first reduction will happen within 6 years with a theoretical retirement reaching a third of the existing fleet, the main reduction happening within ten years.

To give a picture of the future of UTY in terms of locomotives available, a list of available locomotives, year by year, based on their theoretical life is produced underneath:

											F	RS RE	MAININ	IG										
ITEMS	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
DIESEL	479	479	450	450	450	450	450	318	318	318	318	318	95	95	95	95	95	3	3	3	3	3	0	
2TE10P	53	53	24	24	24	24	24	0	0	0	0	(0	0	0	0	 	-				0		
.2TE10M	176	176	176	176	176	176	176	176	176	176	176	176	73	73			-		3	3		3		0
3TE10M	121	121	121	121	121	121	121	121	121	121	121	121	22	-					0	0:		0	0	0
2TE10V	81	81	81	81	i 81	81	81	4	4	4	4						0		0	0		0	0	
2TE116	48	48	48	48	48	48	48	17	17	17	17	17	0	_	0		0		0	0	0	0	0:	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0
ELECTRIC	84	84	35	35	35	35	35	35	35	35	35	35	35	35			-		34	34	34	34	0:	
VL60	28	28	0	0	0	0	0	0	0	0	0		-		0		01		0	0		0	0	<u> </u>
2VL60K	211	21	0	0	. 0	0	0	0	0	0	0	0	0	0	0		0)		0	0:		0	0:	0
VL80S	1	1	1	1	1	11	1	1	1	1	1	1	1	1	1	1	11		0	0:	0	0	0:	0
3VL80S	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34		34	34:	34	341	34	0	0
	0	0	0	0	0	0	0	0	0	0	0	0		0	0		0	0	0	0:	0:	0:	0	0
IOFAL	563	563	4 X5	4 85	4 85	4 85	185	353		353		353	130					3-	3- .	y-		3 - jr		

The need for new locomotives is dependent on traffic level, operational performance and locomotive availability. Most of the improvements proposed on infrastructure will allow to increase travelling times and the utilisation of locomotives, reducing thus the need for further locomotive investments.

4.6.2 New electric locomotives

4.6.2.1 Brief description

There are insufficient modern electric locomotives to meet the very short term fleet needs. About 60 electric locomotives will retired within the next ten years, the majority being due for replacement in years 2-3. Therefore it is proposed to purchase 15 locomotives by that term.

The introduction of new locomotives would considerably reduce operating and maintenance costs.



The need to replace the old electric locomotives could be reduced if modern world market locomotives were considered for both freight and passenger working.

The cost and schedule is the following:

Year	Total	1	2	3	4	5
Purchase 15 new locomotives	37.50			20.00	17.50	

4.6.2.2 Base case

It is assumed that the traffic which may be carried by trains with electric traction will be transported by trains with diesel traction. Due to the shortage of rolling stock by 2008, 17 diesel locomotives will be purchased.

4.6.2.3 Project case

Two main impacts are expected:

- reduction of maintenance cost
- reduction of operation costs (including energy costs)

The IRR would therefore be 30.35 %.

The tree would																	_						
	1999	2000	<u>2001</u>	2002	<u>2003</u>	2004	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	2009	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	2014	<u>2015</u>	<u>2016</u>	<u>2017</u>	2018	2019	<u>2020</u>	TOTAL
Base case: S0																							
investments										51,00													
Maintenance cost	2,88	2,88	288	2,88	2,88	2,88	2,88	2,88	288	2,88	2,88	2,88					2.88					2,88	
Operation cost	6,84	6,84	6.84	6,84	6,84	6,84	6,84	6.84	6,84	6,84					5,47							5,47	
Cash flow	-9,72	-9,72	-9.72	-9,72	-9,72	-9,72	-9,72	-9,72	-9,72	-60,72	-8,35	-8,35	-8,35	-8,35	-8,35	-8,35	-8,35	-8,35	-8.35	-8,35	-8,35	18,17	-221,95
										26,52													26,52
Project case: S1																							
Investments			20,00	17,50																			
Maintenance cost : old loc	2,88	2,88	1.50																				
Operation cost : old loc.	6,84	6.84	3.42																				
Maintenance cost			0.96	1,80	1,80	1,80	1,80	1,80	1.80	1,80	1,80	1,80	1,80						•			1,80	
Operation cost			0.86	0.86	0,86	0,86	0,86	0,86	0.86	0,86	0,68	0.68	0.68	0,68								0,68	
Cash flow	-9,72	-9,72	-26.74	-20,16	-266	-2,66	-2,66	-2,66	-266	-2.66	-2,48	-2.48	-2,48	-2.48	-2,48	-2,48	-2,48	-2,48	-2.48	-2,48	-2,48	11,85	
Residual value			7.33	7,00																			14,33
\$1-90	0.00	0.00	-17.02	-10.43	7.07	7.07	7.07	7,07	7,07	58,07	5,87	5.87	5,87	5,87	5,87	5,87	5,87	5,87	5.87	5,87	5.87	-6,32	124,20

4.6.3 Upgrading of maintenance equipment and facilities

4.6.3.1 Brief description

Four fields of investment are required:

Year	Total	1	2	3	4	5
Upgrade loco workshop	5.00	5.00		•	-	-
Upgrade coach workshops and depots	5.00	5.00		-	-	-
Diesel locomotives depot	5.00	5.00				l
Upgrade wagon workshops and depots	10.00	5.00	5.00		-	
Upgrade Uzbekistan depot	3.00	3.00				
Spares stock	5.00	1.00	4.00	-	-	-

Spare parts

A satisfactory stock of spare parts is required for carrying out satisfactorily the works without any interruption to the work flow. A stockholding of around US\$ 5 m of parts will be required.

Wagon workshops and depots

Improvements on wagon workshops are set at 10 MUSD.

Coaches workshops and depots

Improvements are also required in facilities for overhaul of electrical and electronic components. Component washing facilities should be upgraded. A new paint shop should be provided. Costs are estimated at \$5m.

4.6.3.2 Project case

Loco Workshops.

Some modifications will decrease the frequency of repairs and thus labour and material costs.

Passenger Workshops

Similarly to the loco expenditure, the principal result will be to enable UTY to undertake satisfactorily running and heavy maintenance. It will include amongst other things:

- a new paint shop
- new wheelshop equipment
- purchase of new materials handling equipment

Wagon Workshops

Similarly to the previous ones, the principal result will be to enable UTY to undertake satisfactorily running and heavy maintenance. It will include amongst other things:

- new wheelshop equipment
- · purchase of new materials handling equipment
- introduction of new technologies

When considering an yearly cost of 18 MUSD for maintenance, the investment would be paid back in less than 10 years with a 20% reduction of these maintenance costs.

4.6.4 Locomotives: re-engine

4.6.4.1 Brief description

The experimental transplant of GE power equipment to a 2TE10 locomotive as in Kazakhstan could provide considerable cost savings in the short term, as well as giving some life extension to existing locomotives without inducing strongly on UTY financial accounts. It is recommended that a programme of conversion of ten 2 TE10 M locomotives should be started at the rate of two per year at a cost of \$1.4m per locomotive. The programme is shown underneath:

Year	Total	1	2	3	4	5
Re-engine 40 locomotives 2TE10	56.00	8.40	16.80	30.80		



4.6.4.2 Base case

In the base case it is assumed that locomotives are not modified and are maintained on the same basis as today. Therefore due to their performance, part of the traffic expected may not be transported.

4.6.4.3 Project case

Due to greater availability 40 re-engined locomotives will replace 50 of the original design. Operational savings will produce an attractive pay-back period of 8 years.

It has been estimated that yearly maintenance and consumption ratios for the two type of loco are the following:

	TE10 Loco	Modified Loco
Maintenance and unscheduled repair costs for 1 engine unit (\$)	127,438	6,100
Fuel oil for 1 engine unit (\$)	262,500	201,600
Lubricating oil for 1 engine unit(\$)	35,000	3,500
TOTAL COSTS I ENGINE UNIT(\$)	424,938	211,200

The IRR would be 26.86%:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
Base case : S0																		
Maintenance cost : old	6.37	6.37	6,37	6,37	6,37	6,37	6,37	6,37	6,37	6,37	6,37	6,37	6,37	6.37	6,37	6,37	6.37	
Operation cost : old	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14,88	14.88	14.88	14.88	14.88	
Cash flow	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-21,25	-361,20
Project case : S1																		
Investments	8,40	16,80	33,60															
Maintenance cost : new	0,04	0,11	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0,24	0.24	0,24	0.24	0.24	
Maintenance cost : old	5,35	2,93																
Operation cost :new	1,64	4,72	8,20	8,20	8,20	8,20	8,20	8,20	8,20	8,20	8,20	8.20	8,20	8.20	8.20	8,20	8.20	
Operation cost :old	12,50	8,03																
Cash flow	-27,92	-32,59	-42,05	-8,45	-8,45	-8.45	-8,45	-8.45	-8,45	-8,45	-8,45	-8,45	-8,45	-8,45	-8,45	-8.45	-8.45	-220,84
S1-S0	-6, 68	-11,34	-20,80	12,80	12,80	12,80	12,80	12,80	12,80	12,80	12,80	12,80	12,80	12.80	12,80	12,80	12.80	140,36
IRR	26,86%																	

Pay out time would be around 8 years.

4.6.5 Freight wagons

With the opening of the new refinery in Bukhara, additional tank wagons suitable for carrying petroleum products are strongly needed. Today UTY has to rent tank wagons from Russian and Kazak railways in order to carry it. No figures of the rental cost were provided. No comparison between the rental and the purchase of tank wagons can be produced. Nevertheless the tariff by ton-km of petroleum products carried is the highest amongst all products carried (1.19 Sums to be compared to an average of 0.747 Sums): this market is undoubtedly the most profitable for the railway. Petroleum products account for more than 65% of UTY total freight revenues.

4.7 MIS

4.7.1.1 Brief description

Even if there is some data regarding railway performance available at UTY, it is rarely in a format which could be used for management purposes. While some of the management of some data is already computerised, it should be further extended and the potential use which could be done, should be developed through implementation of additional software. Most of the MIS to be introduced will aim at reducing rolling stock and infrastructure maintenance cost through systematic introduction of repairs and maintenance carried out, failures observed, operation data, in order to adapt the technique used to the real needs.

4.7.1.2 Base case

The main effect being expected is the reduction of maintenance costs. Therefore it is supposed that maintenance costs are remaining at the same level during the whole period: 36,640,000 USD per year.

4.7.1.3 Project case

The investment in MIS will permit to reduce gradually maintenance costs (for both infrastructure and rolling stock) by 6% in 4 years.

The IRR would be 12.8%:

D	<u>1999</u>	<u>2000</u>	2001	2002	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	TOTAL
Base case: S0																						
Maintenance	36,64	36,64	35,64	36.64	36,64	36,64	36,64	36,64	36,64	36,64	35,64	36,64	36,64	36,64	35,64	36,64	35,64	36,64	36,64	36,64	36,64	
Cashflow	-36.64	-36.64	-36,64	-36,64	-36,64	-36,64	-36,64	-35,64	-36,64	-36,64	-36,64	-36,64	-36,64	-36,64	-36,64	-36,64	-36,64	-35.64	-36,64	-36,64	-36,64	-769,36
Base case: St																						
Investments	4,50	6,50	4.25	0,25																		
Maintenance	36,64	35,90	35,17	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34,44	34.44	34.44	34,44	34,44	34,44	
Cash flow	-41,14	42.4 0	-39,42	-34,69	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-34,44	-743,10
S1-90	-4.5 0	-5.77	-278	1,95	2.20	2.20	2,20	2,20	2,20	2,20	2,20	2,20	2,20	2,20	2,20	2,20	2,20	2.20	220	2.20	2.20	26,27
IFR	128%																					

Pay out time would be around 9 years.

4.8 Detailed analysis of the Electrification projects

4.8.1 Introduction

The electrification of the Mekhnat - Dzhizak line would be achievable under EBRD financing rules, under the condition of a cost for remaining works estimated at 27 MUSD. The expected IRR would reach between 10.37% and 11.40%. On top of its financial impact, it would permit to ease the operation of the single track section Khavast-Dzhizak.



The electrification of the Djambai-Marakand section is justified without any doubt, the IRR reaching between 16.40% and 19.33%. On the operational side, it will allow to run passenger trains with electric traction, up to a major station in Uzbekistan, Samarkand.

The electrification of Marakand - Bukhara is more doubtful: its IRR is estimated to be between 5.98% and 8.48%. Nevertheless the 7 MUSD allocated for the electric depot in Marakand which were totally introduced on this section investments, should have been broken down between the three sections concerned, and specifically the Marakand - Djambai and Marakand - Bukhara. Significant operational improvement which are difficult to estimate on the basis of the data available will surely arise through the development of the electrified "silk road" line.

Other socio-economic or commercial benefits weren't included in the benefits of electrification:

- The environmental impact of electrification is overall positive compared to diesel traction, taking into account the sources of electricity in Uzbekistan
- Oil reserve are moderate compared to coal and especially gas reserves; electrification helps shifting to those plentiful sources and reduce the dependancy on oil imports.
- The existence of a full electrified "silk road" line will reduce, through the unnecessity of changing locomotive, travel times, giving back the railways part of its lost competitiveness in passenger transportation. Economic and environmental impacts of the recovering of the passenger business is to be considered.

4.8.2 Hypothesis

4.8.2.1 Traffic

The expected traffic on the sections to be electrified is the following:

Pessimistic scenario

Railway Sections	Length	Tons	Avge load	t e	44. Z			war i	N° trains	s per year		57 \$1. 54			- 10 Sec.
	in km	(in th:)	(in tons)	1 996	-1.997	1 998	1 999	2000	2 001	2002	2 003	2 004	2 005	2 006	2007
Mekhnat-Dzizak	120	2.566		1 842			. 1721	1.819	1.847	1 862	1 801	1 887	1 897	1 898	1.895
INCIGITED CALLERY		2 005	1 221	1 642	1611	1 591	1 689	1 788	1 786	1 774	1 714	1 748	1 735	1 720	1 701
Mekhnat-Khabast	82	was not a contract at				4420	4739	5 056	5.163	5 232	5 063	5 350	5 400	5 404	5395
IVIÇIO II IOR-17 IBLUSION		5 807	1 283	4 526	4 445	4 395	4 843	5 281	5 224	5 140	4 965	4 977	4 898	4 821	4 737
Mekhnet-Dzizak (pot)	120		1724		7,128	7 212C	2273	2 426	2477	2 510	2 429	2 567	2 590	2 593	2 588
INCH B SECTION (POX)		2 785	1 613	2 154	2 115	2 091	2 304	2 513	2 486	2 446	2 362	2 368	2 330	2 294	2 254
Djambei-Marakand	32		1978						5874	5 887	5 696	5 902	5 904	5 907	5 895
Ujali Nar-Watana N	42	8 601	1 648	5 219	5 100	5 000	5 229	5 458	5 402	5 321	5 143	5 163	5 085	4 999	4 905
Manufact Dukham	263						3255			3 469	3 356	3 482	3 486	3 503	3 509
Merakand-Bukhera	200	4 466	1 908	2 341	2 29 1	2 256	2 329	2 407	2 422	2 422	2 342	2 418	2 414	2 392	2 365

Optimistic scenario

Railwey Sections	Length in km	Tons:	to be a section by the		1.997	1.988	1 996	2000	N* train 2:001	9 per yeer 2 002	2 003	2004	2005	2 006	2:007
Mekhnat-Dzizak	120	2 586		1642	1 684	1727	1 886	2055	2161	2254	2-248	2445	2 542	2632	2718
MON A RECEDENCE		2 005	1 221	1 642	1 661	1 692	1 852	2 020	2 101	2 172	2 164	2 317	2 392	2 466	2 536
Mekhnat-Khabast	. 07		751739				5 193	115713C	6029	6313	6 299	6 891	7 184	7 427	7.659
IVICTU II TAIL-TV RIGIURISI	. 04	5 807	1 283	4 526	4 583	4 672	5 309	5 968	6 143	6 289	6 264	6 592	6 749	6 912	7 067
Statement Prince (moth	120	3 744	1724		- 300 375404				"2892"		3 022	3 306	3 446	3 563	3674
Mekhnat-Dzizak (pot)	120	2 785	1 613	2 154	2 181	2 223	2 526	2 840	2 923	2 992	2 980	3 137	3 211	3 289	3 362
Contracts Management	- 20	50 Z 2 Z 2 Z 2 Z	with the west contribution of the	2 13-		5.584		were the second	6 895		7 159	7 755	8 051	8 358	8 653
Dzizak-Marakand.	38	8 601	1 648	5 219	5 259	5 316	5 731	6 168	6 420	6 650	6 628	7 126	7 374	7 615	7 850
1. C	~~~	6303	and a supplementary of	9 2 13	3225	enteres electricas		SOURCE CONTRACTOR OF THE PARTY	4053	4214	4 202	4 543	4712	4 905	5 089
Marakand-Bukhara	263	4 466	1 908	2 341	2 362	2 398	2 553	2 720	2 860	2 988	2 979	3 249	3 383	3 498	3 608



4.8.2.2 Costs and benefits of the electrification

Costs incurred by electrification are the following:

- cost of the investment
- · cost of the maintenance of the installations
- cost of any extra electric tractive units

The investment for electrification is estimated at:

Section	Cost (in MUSD)
Mekhnat - Dzhizak	27
Djambai - Marakand	10
Marakand - Bukhara ²	92
Total	129

Electric installations will need to be maintained. The cost of maintenance per km of line is estimated at 494 USD per year.

Electric tractive units are considered at a unit price of 3 MUSD when diesel are estimated at 2.6 MUSD.

Benefits are purely cost reduction. They concern:

- energy cost
- driving cost
- maintenance cost
- other operation cost
- rolling stock, if needed

It has been assessed here that no traffic increase is to be expected from the electrification project. Nevertheless, the possibility of getting direct trains, through the shortest route, tracted by electric locomotive, without any need for changing locomotive, could put train services back into the market for carrying passengers to the western part of the country. The impact of such capacity was difficult to assess with very precision.

On revenues the provision of improved services would have permitted to increase tariffs making sure that it is competitive with air travel and buses.

Cost reductions are significant:

Electric energy cost in Uzbekistan is very low compared to west European standards (2 Sums per kw/h) when one litre of fuel is 15 SUMS. Thus, the use of electric powered locomotives will permit to reduce significantly energy costs. It has been estimated at 20%. Energy consumption is based on an average of 12 kw/h per ton-km for electricity and 7.10 litre of diesel per ton-km.

² Including the depot for electric locomotive in Marakand

Driving cost will be reduced due to the internal regulation of the railways where maximum driving time hours on electric units is around 20% higher than on diesel.

Typically maintenance cost of an electric locomotive is lower than diesel. In Uzbekistan, maintenance of diesel (0.96 USD per km) is 55% higher than electric (0.60 USD per km). These figures are in line with international standards. Nevertheless, UTY produced a ratio which was significantly different for diesel operation and maintenance cost: 2 USD /km.

Other operation cost may be reduced in some specific cases which will be mentioned if necessary for each section.

The average distance covered every year by each type of locomotive is:

Diesel	132 093
Electric	159 614

It is based on an average of 12.50 hours per day for electric locomotives and 10.34 hours for diesel locomotives. The average speed is set at 35 km/h.

Nevertheless, with new electric locomotives and specifically with a significantly increased extension of the electrified network of UTY, average yearly distance of an electric locomotive could go up to 200 000 km. Considering an average speed of 35 km/h and a 95% availability, it would mean that a loco would run, in average, around 16 hours per day, which is believed to be achievable.

4.8.3 Theoretical case for 1 km electrification

In order to set the order of magnitude for deciding when electrification in Uzbekistan may be justified according to the existing information, we have set a theoretical case which aim is to set the conditions under which the electrification may be justified. Cost of the investment is the key item which sets the conditions which make an electrification viable.

In this theoretical case we made two hypothesis on these costs:

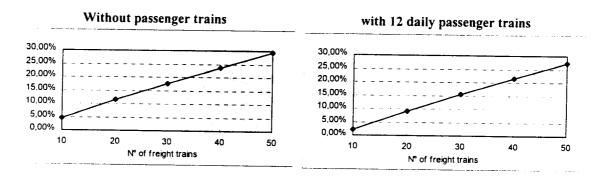
- one which was directly linked to electrification: investment cost were including only substations and catenary,
- the second one was also including high voltage feeders and replacement of the existing signalling and telecommunication installations.

The cost of 250,000 USD electrification for 1 km single track and 400,000 USD for 1 km double track were assumed. This cost doesn't include signalling and telecommunication protection nor high voltage feeding. Several simulation were produced in order to define the level of traffic which would justify the electrification.

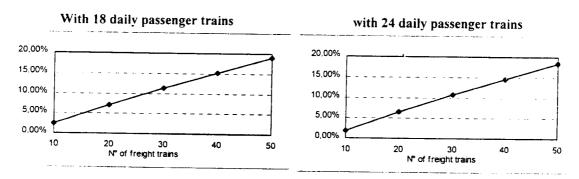
Two hypothesis of passenger traffic were taken for single and double track:

- for single track: no passenger trains and 12 passenger trains per day
- for double track: 18 and 24 passenger trains per day

For single track, the results show that electrification may be justified if the daily freight traffic is above 20 trains:



For double track, traffic should be over 30 trains per day.



Including signalling and telecommunications costs and high voltage feeders, the cost per kilometre of single line could be estimated, as an hypothesis, at 600,000USD. In that case an electrification would be justified if daily about 50 freight trains would go through the line. This figure is hardly achievable in terms of operations.

Due to the average weight of a freight train and, therefore, its consumption of energy, the impact of passenger trains on profitability is low.

For double track it is assumed that one km would cost 900,000 USD. Electrification would be justified with a total traffic of 24 passenger trains and 70 freight trains or 80 freight trains (without passenger trains).

The hypothesis which is shown in annex is considering a 1 km single track electrification, with a cost of 600,000 USD per km, 50 daily freight trains and an average distance of 159,614 km per year per electric locomotive.

4.8.4 Section 1: Dzhizak-Mekhnat

4.8.4.1 Brief description

Dzhizak-Mekhnat section is a single track line, 120 km long. Its electrification will allow to operate electric passenger trains up to Djambai and electric freight trains through the shortest route. This section isn't today very much loaded. Part of the traffic which goes today through the Mekhnat-Khavast route would be diverted to this section: it would concern trains which go on the "Silk Route", Tchengeldy-Bukhara.

Most of the electrification works have already been achieved, a 27 MUSD remaining. The finalisation of the works is planned for year 1 of the investment programme.

Year	Total	1	2	3	4	5
electrification Mekhnat-Dzhizak	27.00	27.00		-		

4.8.4.2 Base case

It is assumed that operation is run on the same principle as today and adapted according to traffic forecasts.

4.8.4.3 Project case

It is assumed that:

- all passenger trains on the corridor are tracted by electric locomotive,
- all freight trains which were running on the Mekhnat Dzhizak section are tracted by electric locomotive,
- freight trains tracted by electric locomotives running on the corridor and which were taking the route through Khavast will be going through the quickest way, Mekhnat-Dzhizak.

The IRR with a maintenance cost for electric locomotives set at 0.96 USD/Km is the following:

Basic Hypothesis 27MUSD	
Optimistic scenario	11.40%
Pessimistic scenario	10.37%
With 24MUSD Investment cost	
Optimistic scenario	12.99%
Pessimistic scenario	12.01%
With 45MUSD Investment cost	
Optimistic scenario	5.95%
Pessimistic scenario	4.93%
With 64MUSD Investment cost	
Optimistic scenario	3.20%
Pessimistic scenario	2.30%

The IRR with a maintenance cost for electric locomotives set at 2 USD/Km is the following:

Basic Hypothesis 27MUSD	
Optimistic scenario	18.43%
Pessimistic scenario	17.57%
With 24MUSD Investment cost	
Optimistic scenario	20.78%
Pessimistic scenario	20.03%
With 45MUSD Investment cost	
Optimistic scenario	10.59%
Pessimistic scenario	9.57%
With 64MUSD Investment cost	
Optimistic scenario	6.75%
Pessimistic scenario	5.79%

The sensitivity analysis produced shows clearly how vital it is to assess exactly the cost of remaining works. If initial UTY costs estimates are used, the project is not viable.

4.8.5 Section 2: Djambai-Marakand

4.8.5.1 Brief description

Djambai-Marakand section is a double track line, 32 km long. Its electrification will allow to operate passenger trains up to Samarkand and freight trains up to the freight terminal called Marakand. This section is the most loaded one in UTY with a daily average of 15 freight trains and 14 passenger trains on each direction.

Most of the electrification works have already been achieved, a 10 MUSD remaining. The finalisation of the works is planned for year 1 of the investment programme.

Year	Total	1	2	3	4	5
electrification Djambai-Marakand	10.00	10.00				

4.8.5.2 Base case

Part of the works having been done, it is assumed that the remaining part won't be finished and electrification won't be operational. Therefore all trains with electric traction will not go further than Djambai, making necessary a change of locomotive in Djambai or anywhere else before. It has been assumed that all trains with electric traction will change their locomotive in Djambai, as being theoretically the more rational way to operate. Nevertheless, for trains running on electrified lines on a short distance, tractive unit may be diesel on the whole route.

4.8.5.3 Project case

It is assumed here, in order to be consistent with the base case, that all trains which are expected to run on this section will be tracted by electric locomotives.

The IRR with a maintenance cost for electric locomotives set at 0.96 USD/Km is the following:

Basic Hypothesis (10 MUSD)	
Optimistic scenario	19.54%
Pessimistic scenario	16.79%
With 11MUSD Investment cost	
Optimistic scenario	17.76%
Pessimistic scenario	15.04%

The IRR with a maintenance cost for electric locomotives set at 2 USD/Km is the following:

Basic Hypothesis (10 MUSD)	
Optimistic scenario	27.38%
Pessimistic scenario	24.56%
With 11MUSD Investment cost	<u> </u>
Optimistic scenario	24.95%
Pessimistic scenario	22.13%

Here again sensitivity to the investment cost is high. Nevertheless, this section being one of the most loaded ones, the impact of investment cost on the profitability ratio isn't as strong as in the previous section. Anyway, Consultant and UTY initial estimates are close and profitability is proved in both cases.

4.8.6 Section 3: Marakand-Bukhara

4.8.6.1 Brief description

The Marakand-Bukhara is a 263 km long section. 79 km being double track. Its total cost was estimated at 280 MUSD, including renewal of signalling and telecommunication equipment, catenary, substation, high voltage feeding and others. We have taken into account that:

- 50% of high voltage feeding is directly related to the railways
- Signalling and telecommunications are not directly linked to the electrification project and therefore shouldn't be included in the evaluation
- Others are overestimated due to the fact that it is including amongst other things a complete track renewal.

Therefore the estimated cost of electrification is shown underneath:

catenary and substations	55 MUSD
high voltage feeder	10 MUSD
Others	20 MUSD
TOTAL	85 MUSD

On top of these 85 MUSD should be added 7 MUSD for an electric depot in Marakand. Though this depot will not bring operational benefits only to the Marakand-Bukhara electrified section, it has been assumed that there is no strong need for such depot if this section isn't electrified. Benefits to the operation on the southern electrified sections aren't taken into consideration in this evaluation. Therefore the cost of such depot should have been allocated partly to the other sections to electrify. In order to be consistent, we have aggregated the costs and benefits of the three sections to be electrified in the overall programme evaluation.

Year	Total	1	2	3	4	5	ì
Electrification Marakand-Bukhara	92.00			37.00	35.00	30.00	

4.8.6.2 Base case

Part of the works having been done, it is assumed that the remaining part won't be finished and electrification won't be operational. Therefore all trains with electric traction will not go further than Marakand, making necessary a change of locomotive in Marakand or anywhere else before. It has been assumed that all trains with electric traction will change their locomotive in Marakand, as being theoretically the more rational way to operate. Nevertheless, for trains running on electrified lines on a short distance, tractive unit may be diesel on the whole route.

4.8.6.3 Project case

It is assumed here, in order to be consistent with the base case, that all trains which are expected to run on this section will be tracted by electric locomotives.

The IRR with a maintenance cost for electric locomotives set at 0.96 USD/Km is the following:

Basic Hypothesis (85 MUSD)					
Optimistic scenario	10.20%				
Pessimistic scenario	8.01%				
With 92 MUSD Investment	cost				
Optimistic scenario	9.29%				
Pessimistic scenario	7.17%				
With 175 MUSD Investmen	it cost				
Optimistic scenario	3.52%				
Pessimistic scenario	1.98%				

The IRR with a maintenance cost for electric locomotives set at 2 USD/Km is the following:

Basic Hypothesis (85 MUSD)
Optimistic scenario	14.92%
Pessimistic scenario	12.57%
With 92 MUSD Investment of	ost
Optimistic scenario	13.73%
Pessimistic scenario	11.44%
With 175 MUSD Investment	cost
Optimistic scenario	6.26%
Pessimistic scenario	4.54%

If we assume that rolling stock rotation will be improved (with a maintenance cost of 0.96 USD/km:

Basic Hypothesis (85 MUS)	D)
Optimistic scenario	12.26%
Pessimistic scenario	9.60%
With 92 MUSD Investment	cost
Optimistic scenario	11.09%
Pessimistic scenario	8.54%
With 175 MUSD Investmen	t cost
Optimistic scenario	4.13%
Pessimistic scenario	2.42%

The electrification project on Marakand - Bukhara section provides result which show some uncertainty on the profitability of the operation. Risks are considered to be high on the basis of the data available. A very detailed operation study would be advisable to assess with much more accuracy the benefits expected.

4.8.7 The overall electrification programme

The overall programme shows an IRR included between 10.32% and 13.20% according to traffic estimates on the basis of an increase of the average number of km per year per electric loco reaching 200,000 km.



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1. Theoretical case

1.1 Table of costs (base case)

YEAR	6661	2003	1002	2002	2003	2004	2002	2006	2007	2008	2009	2010	2011	2012 2	2013 2	2014 24	2015 31	7016	06 2106	0100	0.00	⊢
TKBR passengers (000)	0	0	0	0	0	0	0	0	0	c	6		┿	+	╀	+	+	+	+	+	+	IOIAL
TKBR freight Djambai-Marakand (000)	51100	51100	51100	\$1100	51100	51100	\$1100	_		9		2	9	2		2	2	00118	00113	00113	_	
N° TRAINS Passengers (un.)	0	0	0	0	0	0	0				_									^_	_	
N° TRAINS Freight diesel (un.)	18250	18250	18250	18250	18250	18250	18250	18250	.0	.0	. 0	9	9	_			-					
TRAIN-KM Passengers (000)	0	0	0	0	0	0	0	0				_								<u>-</u>	-	
TRAIN-KM Freight diesel (000)	8-	<u>8</u> 2	8	81	81	<u>«</u>	<u>∞</u>	<u>~</u>	<u>∞</u>		. 8		. =	, <u>«</u>					- 			
10COS	_									1		:	:	+	+	+	+	+	+	+	<u>=</u>	_
Total needs	0	0	0	0	0	0	0	0	0		0	0		_	_		_	_			_	
Needs diesel	0	0	۰	0	0	0	0	0	0	0									_		-	
Needs electric										,	•	•	•							> 	_	
Diesel fleet	0	0	0	0	0	0	0	0	0	0	0	0	_	_	_	_					_	
Electric fleet	0	0	0	0	0	0	0	0	0	0	0	- 0					_	_	_		-	
Investment diesel	0	0	0	0	0	0	0	0	•	0	0					_					_	,
Investment electric	0	0	0	0	0	0	0	0	0												_	- ·
INVESTMENTS (000)	359	0	0	0	0	0	0	•	•						-						_	-
Energy costs (diesel) (000)	75	75	75	7,5	75	7.5	1,4	7,5	3,2	, ,	3,5	3 2	3 6	+	+	+	+	\dashv	\dashv	\dashv	9	359
Energy costs (electricity) (000)			?		:	2	,	3	<u> </u>	· · ·	ς	?		2		75 7	75 7	7 2 7	27 27	5 75	7.5	1640
Operating costs diesel (000)	٣	3	m	٣	3	3		···	٣			~	,,		٠,							• —
Operating costs electric (000)											,	n	n				· 	· 	า 	າ 	ກ —	
OPERATING COSTS	77	77	77	77	77	77	77	77	77	77	77	- //	- 22	77	- '	77 /	77	, ,	- 11			-
Maintenance costs diesel (000)	<u>*</u>	<u>*</u>	<u>~</u>	<u>∞</u>	<u>«</u>	<u>∞</u>	<u>*</u>	<u>*</u>	<u>∞</u>		<u>∞</u>							_		_		1040
Maintenance costs electric (000)							••••					<u> </u>	 :							<u>.</u>	<u>-</u>	282
MAINTENANCE COSTS (000)	8/	18	81	81	81	81	81	81	81	18	87	- 87	8/	- 87	- *	- 81	- 81					> ;
TOTAL	154	95	95	95	95	95	95	95	95	95	95	95							90 90		9 6	G .
Rexidual value													\parallel	-	\dashv	\parallel	\parallel	\parallel	-	\dashv	\dashv	7447
Diesel	37	5	0	0	0	0	0	0	0	0	0	0	0		0		5	0	-	•	c	;
Electric	0	0	0	0	=	0	0	0	0	0	0	0	0	-							> 0	à '
													,								>	>



1.2 Table of costs (case with electrification)

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 2	2014 2	2015 2	2016	2017	2018	2019	2020 1	TOTAL
TKBR passengers (000)	О	o	0	0	С	С	c	С	0	С	С	С	0	0	С	0	0	6	┿	┿	+	+-	
TKBR freight Djambai-Marakand (000)	51100	51100	51100	51100	51100	51100	51100	51100	51100	51100	51100 5	51100 5	2	51100 5	8	3	8	8	2	2	2	21.00	
Nº TRAINS Passengers (un)	0	0	0	0	0	0	0	0	0	0	0	0	0	0									
N° TRAINS Freight electric (un)	18250	18250	18250	18250	18250	18250	18250	8250	18250	18250	18250	18250	8250	8250 1	8250	8250	- 0	- 9		-5	Ş	8250	
TRAIN-KM Passengers (000)	0	0	0	0	0	0	0	0	0	0	0	0						-		_		•	
TRAIN-KM Freight electric (000)	<u>~</u>	8:	<u>«</u>	18	<u>*</u>	8	81	<u>~</u>	<u>8</u>	<u>«</u>	<u>«</u>	8			8	- 81		. 20	~		, <u>«</u>	, <u>«</u>	
1.0008											-			\mid			+	\mid			+	:	
Total needs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	-	0	_	_	c		
Needs diesel						****											,		,		·	·	
Needs electric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0	0	0	0	0	_	
Diesel flect	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	. 0	. 0			
Electric flect	0	c	c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_			
Investment diesel	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	_	. 0					<u> </u>
Investment electric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		_				
INVESTMENTS (000)	343	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				. 22
Energy costs (diesel)-000								-								1	+	+	+	+	 	+	}
Energy costs (electricity)-000	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	16	91	9	91		- 91	- 9	350
Operating costs diesel (000)									-										:	:			3
Operating costs electric (000)	2	2	7	2	2	7	2	2	2	7	2	7	2	7	2	2	7	7	7	7	7	7	
OPERATING COSTS (000)	81	8/	8/	18	8/	18	81	8/	81	81	81	81	81	18	18	18	18	81	87	- 87	. %	- %	350
Maintenance costs diesel (000)																							-
Maintenance costs electric (000)	=	=	=	Ξ	=	=	=	=	=	=	=	=	=	=	=	_	 =	=	=	=	=		741
M.4INTENANCE COSTS (000)	=	1	1		:	=	==	- :	- 11	11	- :	- :	- "	- 11	- "	- 17	- "	: :	: :		: :	- :	
FOTAL	372	29	29	29	53	56	59	59	29	59	29	59	67	59		29	29	56	29	59	- 67	29	086
Residual value																	-	1					
Dieset	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Electric	103	=	=	С	c	c	0	0	0	0	0	c	c	=	0	0	0	c	0				
																				,	,	,	}



1.3 Cash flow (base case)

					2405	2.40
		2020	0 77 18 95	37	5	,
		2019	0 77 18 95		50.	
		2018	0 77 18 95		-95	
		2017	0 77 77 18		-95	
		2016	0 77 18 18		-95	
	Ł	2015	0 77 18		-95	
		2014	0 77 18		-95	
		2013	0 77 18		-, 56-	
	5100	7107	0 77 18	į	-95	
	-	7107	0 77 18 95	,	٠ ٧ -	
	2010	2 0	0 77 18 95	5	ç	
	2000	4	0 77 18	30	5	
	2008	2007	0 77 18 95	90	5	
	2007	- 1	0 77 18 95	30		
	2006	_	0 77 18 95	20-		
	2005		0 77 118 18	20,		
	1997 1998 1999 2000 2001 2002 2003 2004		0 77 18 95	56 -		
	2003		0 77 18 95	-95		
	2007		0 77 18 95	-95		
	5001		0 0 77 77 18 18 95 95	0 -454 -95 -95 -95 -95		
L	2000		359 0 77 77 18 18 454 95	-95		
	<u> </u>		359 77 18 454	-454		
1	8661		0	0		
	/661		0	0		
VE A D	IFAN	Infrastructure investments	Rolling stock investments Operation and energy cost Maintenance cost Total costs Residual value	Cash flow		

1.4 Cash flow (case with electrification)

V 0 V 0																								
TEAK	1997	1997 1998 1999 2000 2001 2002 2003 2004	1999	2000	2001	2002	2003		2005	2006	, 7000	2000	0000	100			-	L	-					
Infrastructure investments	0	009								_		_	27	07 0107	7107 1107	12 2013	13 2014	4 2015	5 2016	2017	2018	2019	2020	
Infrastructure maintenance Rolling stock investments Operation and energy cost Maintenance cost Total costs Residual value	0	0 343 18 11 0 600 372	0 343 18 11 372	0 0 18 18 29	0 0 0 1 1 8 1 2 2 2 2 2 2 3	0 0 1 18 29	0 0 118 129	0 0 118 118 29	0 0 118	0 0 118	0 0 118	0 0 118	0 0 0 0 18 18 11 11 29 29		0 0 0 0 18 18 11 11 29 29	10	0 0 0 0 18 18 11 11	0 0 0 1 29 29	0 0 1 18 0 29	0 0 18 11 29	0 0 18 11	0 0 118	32 0 0 118	
Cash flow	c	600	15	5	5	15	1	-	+			-		_									180	
		67- 67- 67- 67- 67- 715- 000- 0	7/6-	7.7	47-	67-	67-	_	-29	-29	-29	-29	-29 -29	9 -29	67 - 6	9 -29	9 -29	.29	0,	30	°C	۶		
																4	+	4	١	4	,,	67.	119	-1447



2. Mekhnat - Dzhizak section

2.1 Table of costs (base case)

Pessimistic scenario

ressimistic scenario																		
VEAR	6661	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TKBR passengers (000)	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200
TKBR freight Mekhnat-Khavast-Dzhizak (000)	2088875	2252890	2264654	2262322	2187325	2254062	2248283	2232992	2213076	2213076	2213076	2213076	2213076	2213076	2213076	2213076	2213076 2	2213076
I'KBR freight Mekhnat-Dzhizak (000)	979475	1035775	1044120	1045470	1010832	1046175	1045608	1042088	1036117	1036117	1036117	1036117	1036117	1036117	1036117	1036117		036117
N° TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220
N° TRAINS Freight electric (un.)	4578	4938	4962	4956	4791	4935	4921	4887	4842	4842	4842	4842	4842	4842	4842	4842	4842	4842
N° TRAINS Freight diesel (un)	3410	3606	3633	3636	3515	3635	3631	3618	3596	3596	3596	3596	3596	3596	3596	3596	3596	3596
FRAIN-KM Passengers (000)	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226
TRAIN-KM Freight electric (000)	783	151	754	753	728	750	748	743	736	736	736	736	736	736	736	736	736	736
TRAIN-KM Freight diesel (000)	409	433	436	436	422	436	436	434	432	432	432	432	432	432	432	432	432	432
TOCOS																		
Total needs	17	17	17	17	17	17	17	17	11	17	17	17	11	17	17	17	11	11
Needs diesel	12	13	13	13	12	13	13	13	13	13	13	13	13	13	13	13	13	13
Needs electric	2	5	5	Š	5	3.	5	5	5	Ċ	3	5	'n	'n	5	\$	5	S
Diesel fleet	O	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Electric fleet	0	5	5	5	5	5.	5	5	5	5	5	5	\$	Ś	3	5	5	5
Investment diesel	12	_	5	0	0	С	0	0	С	0	0	0	С	0	0	0	0	0
Investment electric	5	0	0	С	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INVESTMENTS (000)	46200	1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy costs (diesel)-000	2323	2405	2418	2420	2369	2421	2420	2415	2406	2406	2406	2406	2406	2406	2406	2406	2406	2406
Energy costs (electricity)-000	159	702	206	705	682	703	701	969	069	069	069	069	069	069	069	069	069	069
Operating costs diesel	234	237	237	238	235	238	237	237	237	237	237	237	237	237	237	237	237	237
Operating costs electric	68	76	47	76	94	96	96	95	95	95	95	95	95	95	95	95	95	95
OPERATING COSTS (000)	3297	3441	3458	3459	3380	3457	3454	3443	3427	3427	3427	3427	3427	3427	3427	3427	3427	3427
Maintenance costs diesel (000)	1570	1593	1596	1596	1582	1596	1596	1594	1592	1592	1592	1592	1592	1592	1592	1592	1592	1592
Maintenance costs electric (000)	470	450	453	452	437	450	6++	446	442	44.2	442	442	445	442	442	442	142	442
MAINTENANCE COSTS (000)	2010	2043	3048	2048	5016	2046	5044	0502	20.33	2033	2033	2033	2033	2033	2033	2033	2033	2033
TOTAL	51537	7384	5506	5507	5399	5503	2499	5483	2460	2460	2460	2460	2460	2460	2460	2460	2460	2460
Residual value																		
Diesel	3244	861	0	0	С	0	0	0	0	0	0	0	0	0	0	0	0	0
Hectric	1200	0	0	0	0	0	0	0	0	0	С	0	0	0	0	0	0	0
																		1



Optimistic scenario

VEAR	6661	2000	2001	2002	2003	1000	2005	2000	2000	9000	0000	0.00						
TKBR passengers (000)	613200	613200	613200	613200	000519	000019	413200	00007	2007	0007	6007	0107	7011	2012	2013	2014	2015	2016
FKBR freight Mekhnat-Khavast-Dzhizak (000)	2289501	" 4	2653625	2748297	2739708	2941851	3040829	002510	3214476	007519	007519	613200			613200			613200
FKBR freight Mekhnat-Dzhizak (000)	1073541	1170457	1224452	1272046	1268101	1369403	1419215	1466577	1511860	0/44/20	0744170	0/44/70			3214476			3214476
N" TRAINS Passengers (un.)	10220	10220	10220	10220	10220	10220	0000	02.001	חלכוון	0001101	0001161	0001161	0981161		0981161		_	211860
N° TRAINS Freight electric (un)	5017	5580	5815	6021	6002	6442	86.99	6852	7037	2027	02201	07701	07701	10220	10220	10220	10220	10220
N° TRAINS Freight dieset (un.)	3738	4075	4262	4476	4412	4762	4034	2000	7507	1501	/60/	/07/	/03/	7037	7037	7037	7037	7037
TRAIN-KM Passengers (000)	1226	1226	1226	1226	3001	70/1	4774	3600	5254	5254	5254	5254	5254	5254	5254	5254	5254	5254
FRAIN-KM Freight electric (000)	3 3	010	770	277	0771	0771	0771	977	9771	1226	1226	1226	1226	1226	1226	1226	1226	1226
IRAIN-KM Freight diesel (000)	440	040	100	616	216	9/9	1012	1042	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070
10008	F	107	5	150	329	2	292	612	631	631	631	631	631	631	169	631	631	631
Total needs	90	90	-61	61	0	2	Ç	2	-	7	;	-			_			
Needs diesel						7 -	07 -	07:	7 :	7	71	71	21	21	71	21	71	21
Needs electric			2 4	<u> </u>	<u> </u>	1 7	4 (4 (4 1	4	4	4	14	4	4	14	4	7
Diesel fleet	· c		2	2	2 0	0 :	0 :	` :	7	_	7	7	7	7	7	7	7	7
Electric fleet	5	. '	2 4	2 `	2 `	2 `	4	4	4	4	14	4	14	4	4	14	14	4
Investment diesel	2	n -c	7 6	0 0	0	ο.	9 0	9		7	7	7	7	7	7	7	7	7
Investment electric	14	> <	5 -	5 6	5 (-	0	0	0	0	0	0	0	0	0	0	-
	n	>	-	0	0	o	0	-	0	0	0	O	0	0	Ö		-	
INVESTMENTS (000)	48800	0	0	0	0	0	0	0	0	0	0	0		•	•	•	5 6	5 7
Energy costs (diesel)-000	2460	2602	2681	2750	2744	2892	2965	3034	3100	3100	3100	3100	3 001	2 6	2 5	2	5	3
Energy costs (electricity)-000	714	794	827	857	854	017	0.48	720	2007	0010	2015	0015	0015	200	3.00	3100	3100	3100
Operating costs diesel	239	245	248	251	25.1	757	2,00	263	2007	7007	7001	700	700	1002	1002	1002	1002	1002
Operating costs electric	86	100	1 1	~	117	127	130	507	507	Ç97	C97	265	265	265	265	265	592	265
OPERATING COSTS (000)	3577	0FZ 2	1870	3076	3066	071	000	45.	1.38	28	138	138	138	138	138	138	138	138
Maintenance costs diesel (000)	1608	1647	1668	1687	16.06	7614	4302	4400	4505	4505	4505	4505	4505	4505	4505	4505	4505	4505
Maintenance costs electric (000)	ý 1 ý	7	200	190	000	07/1	44/	C9/1	1/83	1783	1783	1783	1783	1783	1783	1783	1783	1783
MAINTENANCE COSTS (000)	213	7756	1100	33.5	247	288	(00)	625	£5	£5	<u>6</u>	642	642	642	642	643	642	642
TOTAL		000	6767	0077	2233	2313	7333	7389	7424	2424	2424	2424	2424	2424	2424	2424	2424	2424
Residual value	24434	coxe	90110	6212	619	6505	6655	6795	6269	6269	6269	6769	6269	6269	6269	6269	6269	6929
Diesel	1514	c	c	(•	,												
Classics	+100	-	-	0	0	0	0	0	0	0	0	0	0	0	0	C	c	-
Eleculo	4200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	· c	· c	•
														ı	;	>	>	>



Module B: Uzbekistan

Economic assessment of investments

Table of costs (case with electrification) Pessimistic scenario

000017)		2007	2007	207	7000	7007		1107	7107	C107	5107	2127	2016
007616	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200
1580976	1589231	1587595	534965	581798	1577743	1567012	1553036	1553036	1553036	1553036	1553036	1553036	1553036	1553036	1 553036 1	553036
1035775 1	1044120	1045470	010832	1046175 11	1045608	1042088	1036117	1036117	1036117	1036117	1036117	1036117	1036117	1036117	1036117	1036117
10220	102201	102201	102201	10220	10220	10220	10220	102201	102201	10220	10220	10220	10220	10220	10220	10220
4938	4962	4956	4791	4935	4921	4887	4307	4307	4307	4307	4307	4307	4307	4307	4307	4307
3606	3633	3636	3515	3635	3631	3618	3596	3596	3596	3596	3596	3596	3596	3596	3596	3596
1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226
151	754	753	728	750	748	743	655	655	655	655	655	655	655	655	655	655
433	436	436	422	436	436	434	432	432	432	432	432	432	432	432	432	432
															-	
15	15	15	15	15	15	15	14	14	4	4	41	4	4	14	7	7
								-			-	-				•
15	15	15	15	15	15	15	14	4	14	14	4	4	4	4	14	14
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Ö
						-										
1007	1012	1012	985	1010	1009	1004	866	866	866	866	866	866	866	866	866	866
257	258	258	254	258	257	257	249	249	249	249	249	249	249	249	249	249
1264	1270	1270	1239	1268	1266	1261	1247	1247	1247	1247	1247	1247	1247	1247	1247	1247
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1446	1450	1450	1426	1448	14-46	1442	1388	1388	1388	1388	1388	1388	1388	1388	1388	1388
1446	1450	1450	1426	1448	1446	1442	1388	1388	1388	1388	1388	1388	1388	1388	1388	1388
2710	2720	2719	2665	2716	2712	2703	2634	2634	2634	2634	2634	2634	2634	2634	2634	2634
0	О	0	0	0	С	0	С	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1226 751 15 15 15 1007 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		3633 1226 734 436 15 0 0 0 0 1012 1270 1450 1450 1450	3633 3636 1226 1226 734 753 436 436 15 15 0 0 0 0 0 0 0 0 1012 1012 238 258 1270 1270 0 0 1450 1450 1450 1450 1450 1450	3633 3636 3515 36 1226 1226 1226 12 734 753 72 7 436 436 422 4 15 15 15 4 15 15 15 15 16 15 15 15 10 0 0 0 0 1012 1012 985 10 1270 1270 1270 1239 12 1450 1450 1450 1426 14 1450 1450 1450 1450 14 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1450 1450 1450 1456 14 1450 0 0 0 0 0 0 0 0 0 0 0 0 0 0	3633 3636 3515 3655 1226 1226 1226 1226 734 753 728 750 436 436 422 436 15 15 15 15 15 15 15 15 0 0 0 0 0 0 0 0 0 0 0 0 1012 985 1010 1 1270 1270 1239 1268 1 1450 1450 1426 1448 1 1450 1450 1426 1448 1 0 0 0 0 0 0 0 0 0 0 1450 1450 1426 1448 1450 1450 1426 1448 0 0 0 0 0 0 0 0 0	3633 3636 3515 3633 3631 35 1226	3633 3636 3515 3631 3618 3 1226 1226 1226 1226 1226 1226 1226 1 754 753 728 750 748 743 436 436 436 436 436 434 436 436 436 436 434 434 15 15 15 15 15 15 0 0 0 0 0 0 0 0 1012 985 1010 1009 1004 1004 1004 1012 985 1010 1009 1004 0 0 0 1012 985 1010 1009 0 0 0 0 0 0 0 1450 1450 1426 1448 1446 1442 14 1450 1450 1426 1448 1446 1442 14	3633 3636 3515 3635 3648 3596 3 1226 1227 1249 1244 1242 1244 1446 1442 1448<	3633 3636 3515 3635 3631 3648 3568 3596 3596 3596 3596 3596 3596 3596 3596 3587 3631 3641 3643 3641 3643 3641 3655 655 </td <td>3631 3616 3518 <th< td=""><td>3633 3636 3515 3631 3638 3536 <th< td=""><td> 12.56 12.5</td><td> 12.06 12.0</td><td> 126 126 1276 1226 12</td><td>35.4 35.5 35.5 35.6 35.9 <th< td=""></th<></td></th<></td></th<></td>	3631 3616 3518 <th< td=""><td>3633 3636 3515 3631 3638 3536 <th< td=""><td> 12.56 12.5</td><td> 12.06 12.0</td><td> 126 126 1276 1226 12</td><td>35.4 35.5 35.5 35.6 35.9 <th< td=""></th<></td></th<></td></th<>	3633 3636 3515 3631 3638 3536 <th< td=""><td> 12.56 12.5</td><td> 12.06 12.0</td><td> 126 126 1276 1226 12</td><td>35.4 35.5 35.5 35.6 35.9 <th< td=""></th<></td></th<>	12.56 12.5	12.06 12.0	126 126 1276 1226 12	35.4 35.5 35.5 35.6 35.9 <th< td=""></th<>



1 E.A.K	6661	2000	2001	2002	2003	2004	2005	2006	2007	2008	2000	2010	3011	1010		1		
TKBR passengers (000)	613200	613200	613200	613200	613200	613200	613200	613200	613200	000219	613300	0000017	1107	7107	5107	2014	2015	2016
TKBR freight Mekhnat-Khavast-Dzhizak (000)	1606667	1786551	1862193	1928629	1922602	2064457	2133915		2255773		22525	002510	002610	007510	013200	613200		613200
TKBR freight Mekhnat-Dzhizak (000)	1073541	1170457	1224452	1272046	1268101	1369403	1419215		0981181		070713	6116677	6116677	5115577	2725773	2255773		2255773
N° TRAINS Passengers (un)	10220	10220	10220	10220	00001	02201	00001	00001	0001161	0001161	008116	0981161	0981151	0981151	1511860	1511860	1511860	1511860
N° TRAINS Freight electric (un)	5017	5580	5815	109	6003	07701	07701	07701	10220	07701	07701	10220	10220	10220	10220	10220	10220	10220
N° TRAINS Freight electric (un.)	37.78	4075	C9CF	7426	777	24.42	0000	7000	/60/	/07/	7037	7037	7037	7037	7037	7037	7037	7037
TRAIN-KM Passengers (000)	9661	1226	3027	1336	7144	4/07	4934	8606	5254	5254	5254	5254	5254	5254	5254	5254	5254	5254
TRAIN-KM Freight electric (000)	058	070	0771	0771	0771	9771	9771	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226
TRAIN-KM Freight electric (000)	449	040 480	511	51.6	216	979	1012	1042	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070
TOCOS							725	710	2	120	2	631	631	631	631	631	631	631
Total needs	91	9	19	1.7	1.7		0	0			•	,						
Needs diesel			•	•	-	=	0	0.1	0	×	<u>×</u>	×	<u></u>	<u>~</u>	90	<u>∞</u>	<u>«</u>	18
Needs electric	91	91	19	17	1.1	1.71	~	0	-	0	-							
Diesel fleet	5	0	0	· •	: C	. 0	9 0	• •	0 0	•	<u>×</u>	× •	× (<u> </u>	<u>∞</u>	90	<u>«</u>	8
Electric fleet	5	91	91	91	17	2		> <u>«</u>) ×	3	0	0 9	- -	0 9	0	0	0	0
Investment diesel	ô	9	0	0	0	-	· =	0	2 0	<u> </u>	•	0	<u>×</u>	× 0	<u> </u>	<u>∞</u>	<u>∞</u>	8
Investment electric	91	0	0	=	c	0	. =	· ē		5 6	5 6	5 6	5 6	5 6	o (0	0	0
INVESTMENTS (000)	48000	0	0	0	0	0	. 0	0	9 6	•	9	⊃	0 0	5 6	0 (0	0	0
Energy costs (diesel)-000								5	\$	\$	2		0	0	0	0	0	0
Energy costs (electricity)-000	1027	113	1153	6811	1186	1261	1299	1333	1365	1365	1365	1365	3761	1365		,		
Operating costs diesel		-								-	3	000	cocı	000	5051	265	1365	1365
Operating costs electric	260	273	278	283	283	294	299	104	300	300	300	300	- 00,	ç				
OPERATING COSTS (000)	1287	1385	1432	1472	1469	1555	1598	1637	1674	7674	200	203	606	300	<u> </u>	306	308	308
Maintenance costs diesel (000)	0	5	0	0	0			3	5	* °	*/01	10/4	10/4	1674	1674	1674	1674	1674
Maintenance costs electric (000)	1520	1538	1573	1604	109	999	8091	17.2	1356	0 3	0 }	<u> </u>	0	0	-	0	0	0
MAINTENANCE COSTS (000)	1520	1538	1573	1604	1091	1,666	8091	1730	06/1	00/	96/-	96/	1756	1756	1756	1756	1756	1756
TOTAL	20806	2924	3005	3076	3070	2001	3000	3365	06/1	06/1	96/1	05/1	1756	1756	1756	1756	1756	1756
Residual value					2 2	777	36.70	cocc	2430	3430	3430	3430	3430	3430	3430	3430	3430	3430
Diesel	С	0	0	0	o	0	C	c	c	c	c	ć	•		,			
Electric	14400	0	0	c	: =	, ,	> 3	> 3	> =	> :	-	>	0	0	0	0	0	0
		,	د	2	>	>	D	ɔ	0	0	0	0	0	0	0	0	0	0



2.2 Cash flow (base case)

Pessimistic scenario

YEAR	1661	8661	1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020	2000	2001	2002	2003	2004	2005	2006	2007	2008 2	000	010	110	2012	2013	014	2015 2	910	7102	2018 2	019 2	8
Infrastructure investments													-			\vdash	_	\vdash		╁	T	\vdash	H	Τ
Rolling stock investments			46 200 1 900	<u>8</u>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and energy cost			3 297	3441	3 297 3 441 3 458 3 459 3 380 3 457	3 459	3380	3 457	3 454	3 443	3 427	3 454 3 443 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427 3 427	427	3 427	3 427	3 427	3 427	3 427	3 427	3 427	3 427	3 427 3	427 3	427
Muintenance cost			2.040	2 043	2 048	2 048	2019	2046	2044	2040	2 033	2 033 2	033	2 033	2 033	2 033	2 033	2 033	2 033	2033	2 033	2033 2	033 2	83
Total costs	0	0	0 51537 7384 5506 5507 5399 5503 5499 5483 5460 5460 5460 5460 5460 5460 5460 5460	7384	5 506	2 507	5 399	5 503	5 499	5 483	2460	5 460 5	460	9460	2460	5460	2460	3 460	3 460	2460	2460	5 460 5	460 5	9
Residual value																							7	781
Cash flow	0	0	0 -51 537 -7384 -5506 -5507 -5399 -5503 -5499 -5483 -5460 -54	-7384	-5 506	-5 507	-5 399	.5 503	.5 499	5 483 -	5 460	5 460 -5	460	. 460	5460	5460	5460	9460	9-094	5460	5460 -	5460-5	460 2	184

1																								
YEAR	1997	1998	1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019	2000	2001	2002	2003	2004	2005	2006	2007	2008	5000	2010	2011	2012	2013	2014	2015	9102	2017	8102		2020
Infrastructure investments															-	-			-					Π
Rolling stock investments			48 800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and energy cost			3511	3 749	3870	3511 3749 3870 3975 3966	3966	4 192	192 4 302 4 406	4 406	5 4 505 4	4 505	4 505	4 505	4 505	4 505	4 505	4 505	4 505	4505 4505 4505 4505 4505 4505 4505 4505	4 505	4 505	4 505 4	83
Muinterance cost			2123	2156	2 199	2123 2156 2199 2236 2233 2313 2353 2389 2424 2424 2424 2424 2424 2424 2424 24	2 233	2313	2353	2 389	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424	2 424 2	424
Total costs	0	0	0 54434 5905 6008 6212 6199 6505 6655 6795	5905	9009	6212	6619	6 505	6655	6 795	6769	6269 6269	6269	6769	6769	6769	6769	6769	6269	6269 6269 6269 6269 6269	6269	6769	6269	6269
Residual value																								8014
Cash flow	0	0	0 -54434 -5905 -6008 -6212 -6199 -6505 -6555 -6795 -6929 -692	-5 905	9009	-6212	6199	-6505	-6655	- 562 9-	- 6769-	6269-	6769	- 6769	6269	6269	- 6269	6269	6269	6269	6269	6269	6269	88



2.3 Cash flow (case with electrification)

Pessimistic scenario

YEAR	1661	8661 1661	1999 2000 2001 2002 2003 2004 2005	2000	2001	2002	2003	F007	2005	2006 2	2007	2008 2	3 2009 2	2010 2011		2012 2	2013 2	2014 2015 2016 2017	015 2	910;	2017	2018	2019	2020
Infrastructure investments	0	27 000									•		<u> </u>											
Infrastructure maintenance			611	611	611	6	611	611	611	611	611	611	611	611	611	611	611	611	119	611	611	611	611	119
Rolling stock investments			45 000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and energy cost			1 203	203 1264	1 270	1 270 1 270 1 239 1 268	1 239		1 266	1 261	247	1 247 1	1 247	247	247	1 247	1 247	1 247	1 247	1 247	1 247	1 247	1 247	280
Maintenance cost			1451	1 446	1 450	1451 1446 1450 1450 1426 1448	1 426	1 448	1 446	1 442	1 388	1 388 1	1 388 1	388	388		1 388		388	1 388	1 388	388	1 388	1 388
Total costs	0	0 27 000 47 773 2 828 2 839 2 838 2 783 2 834	47 773	2 828	2 839	2 838	2 783		2831	2822 2753	2 753	2 753 2	2.753 2	2 753	2.753	2 753 2	2 753	2 753 2	753	2 753	3 2753 2	753	2 753	2 588
Residual value					···																		7	21 600
Cash flow	0	0 -27 000 -47 773 -2 828 -2 839 -2 838 -2 783 -2 834 -2 831 -2 822 -2 753	-47.773	-2 828	-2 839	2 838 -	2 783 -	2 834 -	2831	2 822	2 753 -	2 753 -2	. 753 -	2 753	2 753	2 753 -2	753	2 753 -	753 -	2 753 -	2 753 -:	2 753 -:	2 753 1	9012
																						l	l	I

Optimism section of																								
YEAR	1997	1998	1997 1998 1999 2000 2001 2002 2003 2004	2000	1007	2002	2003		2005	2006	2007	2008 2	2009 2	010	2010 2011 2012	012 2	2013 2014 2015 2016	014 2	015 2	016 2	2017 2018	2018	2019	0202
Infrastructure investments	0	27 000																		_				<u> </u>
Infrastructure maintenance			611	611	119	611	611	611	611	611	611	611	611	611	611	611	611	611	119	119	119	119	119	119
Rolling stock investments			48 000	0	0	0	0	0	С		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and energy cost			1387	1385	1 432	1287 1385 1432 1472 1469 1555	1469	1 555	1 598	1637	1 674	1 674	1 674	1 674	1 674	1674	1674	1674	674	1674	1 674	1 674	1674	1365
Minterance			1530	1 538	1 573	520 1538 1573 1604 1601 1666	109	9991	1 698	1 728	1 756	1756	1 756	1 756	1756		1 756		756	1756	1 756	756	756	1756
Total costs	0	27 000	37000 50925 3042 3123 3194 3188 3340	3042	3 123	3 194	3 188		3415 3483	3 483	3 549 3 549	3.549	549 3	6 1 /5	645	645	549 3	645	65	655	3549	3549 3549 3549 3549 3549 3549 3549 3549		3240
Residual value																								22 500
Cish flow	0	-27000	0 -27000 -50925 -3042 -3123 -3194 -3188 -3340	-3042	-3 123	-3 19म	3 188	3340	3415 -	3 483 -	3 549 -] -3415 -3483 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 -3549 19260	549 -3	540	. 540	? - 6 1 5	549 -3	540 -3	549 -3	549	3549	3 549 -3	25	9260



CHAPTER 4

Economic assessment of investments

3. Djambai - Marakand section

3.1 Table of costs (base case)

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ressimistic scenario																						
YEAR	6661	2000	1002	2002	2003	2004	2005 2	2006 20	2007 20	2008 2009	0107 60	1102	2012	2013	2014	2015	2016	7102	2018	2019	T 020Z	OTAL
TKBR passengers (000)	163520	163520	163520	163520	163520 163520 163520 163520	163520	63520 16	163520 163	163520 163	163520 163520	520 163520	20 163520	022591 03	163520	0 163520	163520	163520	163520	163520	63520	163520	Τ
TKBR freight Djambai-Marakand (000)	970524	1017210	970524 1017210 1017532 1011930 978589 999922 993558	1011930	682876	99922 9		986489 977	977404 977	977404 977404	404 977404	04 977404	977404	977404	977404	977404	977404	977404	977404	977404 9	977404	
N° TRAINS Passengers (un)	10220	10220	10220	10220	10220 10220	10220	10220	10220	10220	10220	10220 10220	20 10220	10220	0 10220	0 10220	10220	10220	10220	10220	10220	10220	
N° TRAINS Freight diesel (un)	10764	11279	11276	11208	10839	11065	06601	01 90601	0800 10	10800	0800 10800	00801 00	00801	10800	00801	10800	10800	10800	10800	10800	10800	
TRAIN-KM Passengers (000)	327	327	327	327	327	327	327	327	327	327	327 32	327 327	722 7	7 327	7 327	327	327	327	327	327	327	
TRAIN-KM Freight diesel (000)	344	361	361	359	347	354	352	349	346	346	346 34	346 34	346 346	946	346		346	346	346	346	346	
LOCOS																				-		T
Total needs	5	S	2	2	2	5	2	5	5	5	5	5	5	2	5	5	5	5	S	2	<u>~</u>	
Needs diesel	5	2	5	S	5	5	5	2	Š	\$	5	5	5	2	5	5	5	5	٠,	2	2	
Needs electric																						
Diesel fleet	0	5	5	5	'n	·S	Ň	v)	٦.	5	5	5	5	5	5 5	5	٠,	Ś	5	2	2	
Electric fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Investment diesel	Š	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	S
Investment electric	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INVESTMENTS (000)	13000	0	0	0	0	0	0	0	0	0	0	0	0	0	0 0	0	0	0	0	0	0	13000
Energy costs (diesel)-000	1654	1722	1723	1715	1666	1691	8891	1678	1 1	1664	664 166	664 1664	1664	4 1664	4 1664	1664	1664	1664	1664	1664	1664	36843
Energy costs (electricity)-000																						0
Operating costs diesel	96	86	86	86	96	6	6	16	96	96	96	6 96	6 96	96 96	96	96	96	96	96	8	8	
Operating costs electric				-																		
OPERATING COSTS (000)	1750	1821	1821	1813	1762	t621	1785	1774	1 760	1760 17	0921 0921	09/1 09	0921 0	09/1 0	1760	1760	1760	1760	1760	1760	1760	36843
Maintenance costs diesel (000)	645	099	099	658	647	654	652	649	949	949	949	646 646	16 646	6 646	646	949	949	949	646	979	949	14265
Maintenance costs electric (000)																						0
ALAINTENANCE COSTS (000)	645	099	099	658	647	654	652	6+9	949	949	949 949	646	979	949	5 646	9+9	949	949	949	949	949	14265
TOTAL	15395	2481	1817	2471	2409	2448	2436	2423 2-	2406 24	2406 24	2406 2406	2406	6 2406	6 2406	5 2406	2406	2406	2406	2406	2406	2406	66231
Residual value															-							
Diesel	1351	0	0	0	0	0	0	0	0	0	0	0	0	0	0 (0	0	0	0	0	0	1351
Electric	0	. 0	0	0	0	0	0	0	0	0	0	0	0	0	0 (0	0	0	0	0	0	0



Optimistic scenario	1 000	2000	1007	2002	2003	2004	2002	2006	2007	2008	2009	2010	1102	2102	2013	2014	<u> </u>	<u> </u>		\vdash	2019
IEAN		-[-	+	-	ŧ	063531	163571	161570	063530	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520
TKBR passengers (000)	075691			02250	-	30000	_		_	_	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797
[FKBR freight Djambai-Marakand (000) 1063 /03 1149445	1063703 11.				243033	1 600740							0000	10220	10220	102201	0000	102201	10220	10220	10220
No TRAINS Passengers (un)	102201	10220	10220	10220	10220	0220	107701	10220	07701	07701	07701	07701	07701	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0000	2000	20371	16503	16503	16503	16503
No TD A INC Erencht clessel (un)	11797	12745	13316	13827	13787	14881	15425	15972	16503	16503	16503	16503	16503	50691	50091	cocol	cocol	50501	1000	2000	000
I I I I I I I I I I I I I I I I I I I			117	117	137	127	127	127	327	327	327	327	327	327	327	327	327	327	327	327	377
[TRAIN-KM Passengers (000)	176	/70	776	776	125	1 1	, ,		900	800	808	\$28	878	\$28	528	528	528	528	528	528	528
TRAIN-KM Freight diesel (000)	378	8 0 2	426	442	441	4/6	494		970	076	076	070	2,	3		+	+		+	\dagger	
Locos							,		,			7	7	7	7	4	-	- 4	<u>-</u>	9	9
Total needs	\$	9	9	9	9	9	9	9	•	c	0	0	ο ,	5 \	5 .	5	> 4	5 4	7	•	4
Needs diesel	5	9	9	9	9	9	9	9	9	9	9	9	9	0	0	•	D	0	•	<u> </u>	•
Needs electric	_								-									4	٠,	- 4	<u>,</u>
Discal flast	0	~	9	9	9	9	9	9	9	9	9	o	6	0	6	6	9	5	•	5 6	•
וווייים ווייים			-6	c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5
Electric fleet	<u>, , , , , , , , , , , , , , , , , , , </u>	- -	-	•	, (- <	c	C	0	0	0	0	0	0	0	0	0	0	0	0
Investment diesel	~	-	ò	5	5	> :	> 6	0 0	0	5 6) c		c	-	-	0	c	0	0	-0	0
Investment electric	0	0	С	ē	0	o	5	5	<u> </u>	5	5	5	5	· (, ,	•	,	•	•	•	•
INTEGRALENTS (000)	13000	1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n	9	5	•	•
(20)	1700	510	1001	2058	2053	7612	5269	2342	2412	2412	2412	2412	2412	2412	2412	2412	2412	2412	7417	7417	71157
Energy costs (diesel)-000	2	:	<u>.</u>	-	!					_			_				•	-	-		
Energy costs (electricity)-000	-			-	-	-		00.1	122	133	133	122	122	122	122	122	122	122	122	122	122
Operating costs diesel	<u>-</u>	105	8 01	=	=	=	=	07	4	4	1	:	•	!							
Operating costs electric	-					-	,		7636	7631	7636	3527	2534	F236	2534	2534	2534	2534	2534	2534	2534
OPERATING COSTS (000)	1681	2020	2098	2168	2163	7317	7380	1047	4507	+667	*CC7	+667	100	200		100	2	821	23	821	821
Maintenance costs diesel (000)	929	705	723	739	737	177	788	608	8.71	8	977	170	170	170	170	170	7	;	;	;	
Maintenance costs electric (000)									-	;		;				631	100	8 2 1	823	827	128
MAINTENANCE COSTS (000)	929	705	723	739	737	177	788	805	821	97/	178	179	179	170	170	170	170	3356	1366	1166	3365
TOTAL	15567	1626	2821	2907	2900	3083	3174	3266	3355	3355	3355	3355	3355	3333	cccc	cccc	cccc	cecc	3333	2333	33 33
Rexidual value				•	•	•	¢	5	c	<	•		<	•	0	C	0	0	0	0	0
Diesel	1351	861	0	0	0	>	> •	o •	> <	> <	> <	•	> <	, ,			_	_	0	0	0
Electric	0	Þ	0	0	0	0	0	0	0								}	,	,		



3.2 Table of costs (case with electrification)

Pessimistic scenario

ressimistic scenario																					
YEAR	1999	2000	2001	2002	2003	2004	2005	2006 2	2007 2	2008 2	2009 20	2010 2	2011 2	2012 2	2013	2014 2	2015 20	2016 20	, 1210	2018	3010
TKBR passengers (000)	163520	163520	163520	163520	163520	163520	163520 1	163520 10	163520 10	163520 16	163520 16	163520 16	63520 16	0	0	10	10	╁	c	+	003531
TKBR freight Djambai-Marakand (000)	970524	1017210	1017532	1011930	978589	999922	993558 9	986489 97		977404 97	977404 97				_						077404
N° TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220					`		`	`	`_	0000
N° TRAINS Freight diesel (un)	10764	11279	11276	11208	10839	11065															07701
TRAIN-KM Passengers (000)	327	327	327	327	327	327	327	327	327	327					327		<u>. </u>				33.7
TRAIN-KM Freight dieset (000)	344	361	361	359	347	354	352	349	346	346	346	346	346	346	346	346		346	346	345	346
S0207									\vdash			-	-		+	+				2	?
Total needs	77	4	4	4	7	4	4	4	4	4	4	4	4	4	4	7	₹	-	_	_	
Needs diesel										-					•	r	+	+	+	;	;
Needs electric	7	4	च	4	*1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	7	_
Diesel fleet	5	0	5	0	0	0	0	0	0	Ö	0	0	0	0							۲ (
Electric fleet	5	न	7	77	7	4	7	4	4	4	4	4	4	4	4	4	4	₹	•	> <	-
Investment diesel	0	0	=	0	0	С	- -	0	0	0	0	0	0			· c	r c	F C		+ 0	+ <
Investment electric	~	8	0	Э	0	О	0	5	0	0	0	0	0	· c	· c	- C	- -	o c	- c	· ·	-
INVESTMENTS (000)	12000	0	0	0	0	0	0	0	0	0	0	0	0	0	•	•	· •	0	> <	> e	5 6
Energy costs (diesel)-000													-		+	+	1	<u>, </u>	<u>}</u>	•	•
Energy costs (electricity)-000	353	368	368	366	356	363	361	358	356	356	356	356	356	356	356	356	356	356	356	356	356
Operating costs diesel																3	3	3	2	3	2
Operating costs electric	7.7	7.9	52	78	77	78	78	17	17	11	11	11	77	77	77	11	1.7	77	7.7	7.7	
OPERATING COSTS (000)	430	447	147	445	433	0++	438	436	432	432	432	432	432	432	432	432	432	432	432		, ,,
Maintenance costs diesel (000)		-													!	1	•	•	•	7	76
Maintenance costs electric (000)	£03	1 13	413	14	707	409	407	406	404	707	404	404	404	404	404	404	707	401	404	404	70
MAINTENANCE COSTS (000)	403	413	413	111	404	400	407	406	404	404	404	104	404	404	404	707		707	707	1	3
TOTAL	12833	859	829	856	837	849	845	841	836	836	836	836	836	836	836	836		836	92.00	918	938
Residual value																					
Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	О	c	c	c	•	c
Electric	3600	0	0	0	0	0	0	٥	0	0	0	0	0	0	0		· c	· c	· c	· c	· -
								-						,		,	,	>	•	,	,



Optimistic scenario

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	3016	0100
TKBR passengers (000)	163520	163520	163520	163520	163520	163520	163520	163520	163520	163320	163520	163520	163520	163520	163530	003531	00.2071	00.5051	4	4	(10)
[FKBR freight Djambai-Marakand (00] 1063703 1149445 [1201168 1247448 1243853]	1063703	1149445	1201168	1247448	1243853		392107		_=					180707	_						075501
N° TRAINS Passengers (un.)	102201	10220	10220	10220	10220	10220	102201				-			00001		_	_		Ξ.		489797
N° TRAINS Freight diesel (un.)	11797		7112	76851	13787	1001	30731	2003	16503	07701	0770	07701	07701	07701	07701	0770	07701	07701	07701	102201	102201
TDAIN KM Daggard (000)	337			7200		001	(740)	21.60	cocol	50501	5050	160001	16503	16503	16503	16503	16503	16503	16503	16503	16503
I I I I I I I I I I I I I I I I I I I	775	175	775	775	327	327	327	327	327	327	327	327	327	327	327	327	327	327	327	327	127
TRAIN-KM Freight diesel (000)	378	408	426	442	441	476	464	511	528	528	528.	528	528	528	528	528	528	\$28	\$0\$	800	000
1.0COS								-										+	1	937	37
Fotal needs	4	\$	5	\$	~	~	5	5	5	S		\$	- ⁄-	٧.	٧	Ÿ	· ·	V	-,	v	
Needs diesel					-				'	ı)	5)	,	1	`	ń	n	ń	n	<u>^</u>
Needs electric	4	'n	5	'n	2	5	3	5	'n	· ·	50	· ·	4	~	v	~	7	V	v		-,
Diesel fleet	0	0	0	0	0	c	0	0	Ö	0	0	0	6		٠ ٥	n c	٦ ٥	n (n c	n (<u> </u>
Electric fleet	0	7	5	'n	5	Ş	S	5	2	٠,	•	٧ (· ·	· ·	· •	5 1	5 v	> 1/	5 4	5 V	5 4
Investment diesel	0	2	0	0	0	5	0	C	0	0	. 0	0	0	· c	1 0	n c	٦ ٥	ń c	n c	n c	n (
Investment electric	ग	_	0	0	0	0	0	0	0	0	0	0	0	· -	-	0 0	5 6	0 0	> <	5 6	5 6
INVESTMENTS (000)	12000	2759	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	9	9	> e	٥ (
Energy costs (diesel)-000													\dagger	+	+	1	+	,	3	•	•
Energy costs (electricity)-000	383	40%	425	440	439	470	485	300	515	515	515	515	\$15	515	\$15	3.5	313	7	313	313	212
Operating costs diesel													}		-	-		<u> </u>	<u> </u>	cic	<u>cı</u> c
Operating costs electric	18	84	98	88	88	92	94	96	86	86	86	86	86	-86	8	ŏ	ő	ŏ	8	ô	00
OPERATING COSTS (000)	463	463	211	\$28	979	195	879	969	613	613	613	613	6/3	2/9	219	219	2/3	? ?	2	0 1	۶ ;
Maintenance costs diesel (000)													}	}	;	3	3	3		CTO	CIO
Maintenance costs electric (000)	423	7	452	462	461	182	492	503	513	513	513	513	513	513	513	513	\$13	513	- C 1 5	- (1)	
ALAINTENANCE COSTS (000)	423	111	452	462	19#	482	492	503	513	5/3	5/3	213	2/3	213	275	213	213		616	2	2 :
TOTAL	12886	3693	963	686	786	1043	1071	6601	1126	1126	1126	1126	1126	1126	1136	11.56	9611	7011	21.0	2611	200
Residual value																			2	0711	271
Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	c	_	•	c	•
Electric	3600	920	С	0	0	0	0	0	C	0	0	0	0	0	0	0	0	0	· c	· •	> <



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3.3 Cash flow (base case)

Pessimistic scenario

YEAK	1997	8661	1997 1998 1999 2000 2001 2002 2003	2000	2001	2002		7007	2005	2006	2007 2	2008 2	2009	2010 2011	7 15	2012	2013 201	3	16 201	300	2000	198	1	7=
Infrastructure investments								T	\dagger			+	+		+		3	3	5	2014 2015 2010 2017 2018 2019 2020	, 2018	3	B B B B B B B B B B	·
Rolling stock investments			13000	<u> </u>	0	3	0	_	0														_	
Operation and energy cost			1750	1821	1821	1813	1762	\$	38.	17.	292	192	- <u>-</u>	760	200									
Maintenance cost			\$5	99	8	83	8	3	652	. 2				3 3	_	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	/1 /00/1	200	9 3	79/I 190/I	1,60	_	_	
Total costs	2	C	15305 2481 2481	2481	1877	2471	4.			- 1	- []	- 1	- 1		- 11	- 1	- 1	- 1	- 1	- 1	- 1	646	646	
Residual value		·		2	2	5		•		<u>7</u>	7	7 00#3	7 000	740 0	2400	2406 2406	2406	2406 24	2406 2406	36 2406	6 2406	2406	2406	
	,	1]	1		1	\dashv															1351	
CASILLOW	5	5	0 -15395 -2481 -2481 -2471 -2409	-2481	-2481	-2471		-2448 -:	2436	2423	-2436 -2423 -2406	3406 -2	3406 -2	206	406	406 - 24	27	2,	240	7.000	2408	2000	1050	C/000
															$\frac{1}{1}$					2	72.7	3	-100	000

VEAD	100	3	1							-														
IFAK	1997	36	1997 1998 1999 2000 2001 2002 2003	2007	<u> </u>	2002		2004	2005	2006	2002	2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2015 2016 2001	600	010	2011	2012 2	013	014	014 2	NIK 3	710	1010	1010	3
Infrastructure investments									T	T	+	\dagger	+	\dagger	+	+	+	+	1	7	1	org	200	2020
Rolling stock investments			13000	1900		_	~						-					-						
			7	3	5	5	>	5	5	>	5	5	5	<u> </u>	0	0	0	0	<u> </u>	=	~	_	<	~
Operation and energy cost			<u>(%</u>	2020	2098 2168	2168	2163	2312	2386	2461	25.22	2534	2534) VESC	7537	7524	763							5
Mindersury			763		ķ	Ę	f	į							7	3	*	7 X (7	2 <u>4</u> 2	2 4 2	234	次 女 公	23.4	23.4
i validad and and cook			0/0		(C) (C)	Ŝ	/?/	=	88	S	<u>~</u>	- -	<u>~</u>	2	2	2	2							
Total onsts	_		mor 1967 1000 1000 1000 1000 1000	7676	چ	2	8	505	7.17			- 1	- 1			3	3			- 1	5	<u>-</u>	<u></u>	<u></u>
	5	5	2	3	1707	2	22	3	31/4	2700	355	3355	3355	3322	3355	3355 3	3355 3	3355 3	3355 3	3355 3	2255	2256		25
Residual value						_																		25
												-				_								2010
Carlo	_	C	moc 1500 1000 1000 1000 1000 1000 1000 100	JCJV	2831	7007	C	2000	7174	3366	33.66	1	 		1	+	+	+	1	-	-	-		1.747
	7	5	10001	3	737	1007-	37.7	2007	<u>・</u> サーで	- 2007	-1555	-300 -31 4-3200 -3351 -3351 -3351 -3354 -3355 -3355 -3355 -3355 -3355 -3355 -3355 -3355 -3355 -3355 -3355 -3355	- 1555	4355	33551-	33551 -	355	7355	255	2556 2	1256	, 2200	2200	
							1									1	3	7		7		-		2



TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

Economic assessment of investments

3.4 Cash flow (case with electrification)

Pessimistic scenario

	7070			0 }	432	\$	8	9099	5732
900	4107		32	0 9	432	\$	8		\$
0100	2018	- 6	32	0 (437	404	898		8 8
2017	107		77	•			898		8 8
3016	0107	ξ	35	<u>ح</u> (452	₽ ₽	8		\$
2015	2102	۶	7) (704	<u>₹</u>	898		898- 898-
2014	2017	٤	7 0) ç	7,5	4 4 4	88		898-
2013	200		7 0	73.0	77	\$	%		898-
2012	2	22	3 6	73	7 5	₹	8		898-
2011		3	1 0	433	100	\$	%		-868
2010		3	1 5	432	2 5	\$	8		898-
2009		3	1 0	432	\$	\$ 8	\$		898-
2008		3		432	\$	\$ 8	% %		%
2007		33		432	ξ	\$ 8	×		<u></u>
2006		32		436	400	3 8	8/3		<u>Ş</u>
2005		32		438	<i>TUP</i>	3 2	//ø		148-
2004		32	C	4	400	ı	8		\$
2003		32	0	433	4	1		1	\$
2002		32	0	445	411	ŀ	8	18	8
2001		32	0	447	413		160	1	\$
2000		32	0	447	413	t		8	\$
1999 2000 2001 2002 2003		32	12000	430	403	100001	000	2,000	698- 888- 168- 168- C0871- mm1- n
1998	00001					ww	3	1	mm
1997	0					٥	5	-	<u>-</u>
YEAR	Infrastructure investments	Infrastructure maintenance	Rolling stock investments	Operation and energy cost	Maintenance cost	Total costs	Residual value	Osch Box.	CASH LIOW

YEAK	1661	1997 1998 1999 2000 2001 2002 2003	1999	2000	2001	2002		2004	2005	2006	2007	2008	2000	2010	2011	2012	2013	2014 20	115		ļ	ᆫ	
Infrastructure investments	0	0000					+				-						_		0107 C107	107	/ 2018	8 2019	2020
Infrastructure maintenance		-	32	32	32	32	32	32	32	32	32	32	32	32	33	3	3	3					
Rolling stock investments			12000	2759	0	0	0	0	0	0	0	_	0	<u> </u>	-	, =	1 6	1 0		<u>3</u> - 2	7 2	٠ ١	٠ ` ١ ٢
Operation and energy cost			463	493	511	878	526	28	579	38				613									<u>ه</u> د
Maintenance cost			423	4	452	462	194	482	492	503	513	513	513	213	213	212	212		0 (1)			510 510	
Total costs	0	10000 12917 3724	12917	37724	1001 500	1001	1010	1075	101	1131			- 1		- 1	- 1		- 1	- [-	- 1	- 1	- 1
Residual value		····		i i			<u> </u>	3	3						 & C					1158 1158	58 1158		
1 de	-	3330			- 1			+	+		1	\dashv					-						7520
Cabil How	<u>-</u>	0 - 1000 - 1291 / -3724 -905 - 1021 - 1019	11671	-3/24	C(A-	-1021	- 6101	-1075 -1103 -1131	- <u> </u>	-1131	-1158 -1158 -1158 -1158 -1158	158	1158	158 -1	158	1158	9511-8511-8511-8511-8511-8511-8511-8	28	85	\$11.85	×11-	0 115	1



4. Marakand-Bukhara section

4.1 Table of costs (base case)

Pessimistic scenario

I cosminant occinant																		
YEAR	6661	2000	1007	2002	2003	2004	2002	2006	2002	2008	5005	2010	2011	2012	2013	2014	2015	9107
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955
[TKBR freight Marakand-Bukhata (000)	4346785	4529620	1570721	4578296	4427750	4585260	4585019	4581751	4266174	4566174	4266174	4266174	4566174	4566174	4566174	4566174	4266174	4266174
N° TRAINS Passengers (un)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570
N° TRAINS Freight diesel (un)	5594	5829	5882	1685	8698	8900	2900	5895	5874	5874	5874	5874	5874	5874	5874	5874	5874	5874
IRAIN-KM Passengers (000)	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728
TRAIN-KM Freight diesel (000)	1471	1533	1547	1549	1498	1552	1552	1550	1545	1545	1545	1545	1545	1545	1545	1545	1545	1545
TOCOS																		
Total needs	24	25	25	25	24	25	25	25	25	25	25	25	25	25	25	25	25	25
Needs diesel	7.	25	2.5	25	24	25	25	25	25	25	25	25	25	25	25	25	25	25
Needs electric													_					
Diesel fleet	0	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Electric fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment diesel	7.	_	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Investment electric	0	9	0	0	0	C	0	0	0	0	0	0	0	0	0	0	-	0
INVESTMENTS (000)	97100	1900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Energy costs (diesel)-000	1092	7868	7928	7939	7719	7949	7949	7944	7921	7921	7921	7921	1262	7921	7921	7921	7921	7921
Energy costs (electricity)-000				.,														
Operating costs diesel	457	466	468	468	19†	469	469	468	468	468	468	468	468	468	468	468	468	468
Operating costs electric				-														
OPERATING COSTS (000)	808	8.334	8396	8107	8180	8417	8417	8412	8389	8.389	8389	8389	8389	8389	8389	8389	8389	8389
Maintenance costs diesel (000)	3071	3131	3144	3146	3097	3148	3148	3147	3142	3142	3142	3142	3142	3142	3142	3142	3142	3142
Maintenance costs electric (000)																		
MAINTENANCE COSTS (000)	3071	3131	3144	3116	3097	31.18	3148	3147	3142	3142	3142	3142	3142	3142	3142	3142	3142	3142
TOTAL	73529	13364	11539	11553	11277	11566	11565	11559	11531	11531	11531	11531	11531	11531	11531	11531	11531	11531
Residual Value																		
Diesel	6487	198	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electric	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Optimistic scenario			
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Optim		ò	2
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	3016	0102	003333	4200174	6570	5874	1728	277	1345	25	25		25	0	0	0	0	7921		468		8389	3142		3142	1531		
	2015	-			6570	5874	1728	1545	1	25	25		25	0	0	0	0	7921		468		8389	3142			11531		
	2014	1		_	6570	5874	1728	1545		25	25		25	0	0	0	0	7921	,	468			3142		<u>.</u>	11531		
	-	1:5			6570	874	1728	545		25	25		25	0	0	0	0	1921		468			3142					
	2013	\perp	_							25	25		25	0	0	0	0								_	11531		
	2012	863955	_	<u> </u>			1728	1545										192		408	0.00	4969	3142		3142	11531		
	2011	863955	4566174		070	5874	1728	1545		25	25		25	0	0	0	0	7921	071	100	9 2 9 0	2147	2147	:	3142	11531		
	2010	863955	4566174	11657	0760	5874	1728	1545		25	25		25	0	0	0	0	7921	146	90	8 280	2142	7+15		3142	11331		
	5009	863955	4566174	0239	0,00	28/4	1728	1545		25	25	•	25	-	0	0 (0	7921	468	3	8 380	3142	71.0	;;	2416	Icell		•
	2008	863955	4566174	0229	7.00	28/4	1728	1545		25	25		52	0	_	0 6	0	1921	468		8389	3142	1	2777	11531	110011		
	2007	863955	4566174	0259	101	700	1728	1545		25	25		7	0	0	0 6	n 1002	176/	468		8389	3142	!	21.43	74.5	16611	•	
	2006	863955	4581751	6570	5005	0000	87/1	1550		25	?	Č	9	5 0	5 (ک د	207	7944	468		8412	3147		3147	11550		c	
	2005	863955	4585019	0570	2000	226	97/1	1332		2 2	9		67	5 6	> 3	÷ •	7040	646	469		8417	3148		3148	11565		•	
100	20014	863955	4585260	6570	2000	1730	07/1	755		7 7	<u> </u>	36	3 0	0 0	= =	· •	7040	6467	469		8417	3148		3148	11566		c	=
.000	2003		4427750	6570	3698	1730	07/1	1438	7	7 6	÷,7	3.5	3 6	5 6	= =	•	7710	-	191		8180	3097		3097	11277		<	
2002	7007			6570	1685	1728	1540	747	2	6 6	7	36	} =	o c	= =	0	7910		468		8407	3146		3116	11553		0	
1000	+		_	6570	5882	1728	1547	5	γ̈́	2 %	3	25	=	· 6	· s	0	7928		468		8396	3144		3144	11539		c	•
2000	٠,		_	6570	5829	1728	1513	1	35	; ;	}	24	0	_		1900	7868		95,7	_	8334	3131		3131	13364		861	
1990	٠,			6570	5594	1728	1471		24	7.	 i	С	3	77	3	97400	1097		457		8028	3071		3071	73529		6487	
١	3	° ;	? —					-							-	-	_								7		-	
YEAR	IKBR passengers (000)	IKBR freight Marakand-But bara (000)	Jo TD A INIC Description (CAXV)	N TRAINS LASSCHBCIS (III)	N° TRAINS Freight diesel (un.)	FRAIN-KM Passengers (000)	FRAIN-KM Freight diesel (000)	SOJO	Fotal needs	Needs diesel	Needs electric	Diesel fleet	Electric fleet	nvestment diesel	nvestment electric	INVESTMENTS (000)	energy costs (diesel)-000	energy costs (electricity)-000	perating costs diesel	Operating costs electric	UPERATING COSTS (000)	Maintenance costs diesel (000)	Maintenance costs electric (000)	MAINTENANCE COSTS (000)	FOTAL	Residual Value	Diesel	



4.2 Table of costs (case with electrification)

Pessimistic scenario

YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863055	861055
IKBR freight Marakand-Bukhara ((XX))	4346785	4529620	4570771	4578296	4427750	4585260	4585019	4581751	4566174	4566174	4566174	4566174	4566174	4566174	4566174	4566174	4566174	4566174
Nº TRAINS Passengers (un.)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	0259	0239
Nº TRAINS Freight diesel (un)	5594	5829	5882	1685	\$698	5900	5900	5895	5874	5874	5874	5874	5874	5874	5874	5874	5874	5874
TRAIN-KM Passengers ((XX))	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	17.8	130
TRAIN-KM Freight diesel (000)	1471	1533	1547	1549	1498	1552	1552	1550	1545	1545	1545	1545	1545	1545	1545	1545	1445	37.7
SO207																		3
Total needs	20	20	21	21	20	21	21	21	21	21	21	21	21	21	21	7	21	7
Needs diesel								-					i	i	i	i	;	1
Needs electric	20	20	21	21	20	21	21	21	21	21	21	21	21	21	21	21	1,0	-10
Diesel fleet	0	С	0	0	0	0	0	0	0	0	0	0	0	C	· C	; =	i	; =
Electric fleet	0	20	20	21	21	21	21	21	21	21	21	21	21	21	2.0	2 5	, 5	, =
Investment diesel	0	0	0	0	0	0	С	0	0	0	0	0	0	Č	; °	i	; 0	; 0
Investment electric	20	5	-	0	0	0	0	0	0	0	0	0	0	· c		· c	· c	-
INVESTMENTS (000)	00009	0	0	0	0	0	0	0	0	0	0	0	0	0	9	•	•	9 6
Energy costs (diesel)-000																-	1	ì
Energy costs (electricity)-000	1624	1891	1694	9691	1649	8691	1698	1691	1693	1693	1693	1693	1693	1693	1693	1693	1691	1693
Operating costs diesel																	2	3
Operating costs electric	366	373	374	375	369	375	375	375	374	374	374	374	374	374	374	374	374	174
OPERATING COSTS (000)	0661	2054	2068	2071	2018	2073	2073	2072	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067
Maintenance costs diesel (000)								•					 .	}			Ì	ì
Maintenance costs electric (000)	1920	1957	1965	1966	1936	1968	1968	1961	1961	1961	1964	1961	\$	26	5	7/0	8	8
MAINTENANCE COSTS (000)	0261	1957	1965	1966	1936	1968	1968	1961	1961	1961	1961	1961	1961	F961	7967	F901	106.4	106.4
TOTAL	63909	1010	4033	4037	3954	4041	707	4039	4030	4030	4030	4030	4030	4030	4030	4030	4030	4030
Residual Value																		
Diesel	0	=	0	С	0	С	0	0	0	=	0	0	0	С	0	c	-	_
Electric	18000	0	=	0	0	0	0	0	0	0	Э	0	0	0	0	0	0	· c



0

Optimistic scenario

VEAR	<u>666</u>	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863055	863055
TKBR freight Marakand-Bukhara (000)	476-4098	5118443	5372517	559572.4	5579820	6054207	6289759	6528701	6757886	6757886		6757886	6757886	6757886	6757886	6757886		9882529
N° TRAINS Passengers (un.)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570		6570	6570	6570	6570	6570		02570
N° TRAINS Freight diesel (un.)	6131	6587	6914	7201	7181	7792	8095	8402	8697	8697	2698	2698	2698	8697	8697	8697	8697	8607
TRAIN-KM Passengers (000)	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1778	1778	1728
TRAIN-KM Freight diesel (000)	1613	1732	8181	1894	6881	2049	2129	2210	2287	2287	2287	2287	2287	2287	2287	2287	2287	22,1
1.0008																		
Total needs	21	22	22	23	23	24	24	25	25	25	25	25	25	25	25	25	25	25
Needs diesel															<u> </u>		3	}
Needs electric	21	22	22	23	23	24	24	25	25	25	25	25	25	25	25	25	25	25
Diesel fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	<u> </u>	} ~
Electric fleet	0	21	22	22	23	23	24	24	25	25	25	25	25	25	25.	35.	2 2	35
Investment diesel	0	0	0	0	5	0	0	0	0	0	0	0	0	0	C	-	}	} <
Investment electric	21		0	-	0	_	0	-	0	0		0	0	· c	· c	- c	· c	-
INVESTAIENTS (000)	00089	2759	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	-
Energy costs (diesel)-000																· -		· [
Energy costs (electricity)-000	1754	1865	1944	2013	2008	2156	2230	2304	2376	2376	2376	2376	2376	2376	2376	2376	9226	2276
Operating costs diesel											:					}	2	2
Operating costs electric	382	395	405	414	413	432	144	450	459	459	459	459	459	459	459	459	459	450
OPERATING COSTS (000)	2136	7760	2349	2427	2422	2588	7.97	2754	2835	2835	2835	2835	2835	2835	2835	2835	2835	2835
Maintenance costs diesel (000)																}	}	
Maintenance costs electric (000)	2004	2076	2128	2173	2170	2266	2314	2363	2409	2409	2409	2409	2400	2409	2400	2400	2400	2400
AL4INTENANCE COSTS (000)	5007	2076	2128	2173	2170	2266	2314	2363	2409	2409	540a	5409	5-109	6017	60Fc	0//7	2,000	00FC
TOTAL	67140	7095	4477	4600	4592	1854	4985	5117	5244	5244	5244	5244	5244	5244	5244	5244	524	5244
Residual Value																		
Diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	c	-
Electric	18000	920	0	0	0	0	=	0	0	0	0	0	0	· c		· c	· c	· c
															•	,	2	١



4.3 Cash flow (base case)

Pessimistic scenario

YEAR	1661	866	966	1997 1998 1999 2000 2001 2002 2003 2004	1002	2002	2003	7007	2005	2006	2002	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Infrastructure investments																							
Rolling stock investments		-	52400	005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	_
Operation and energy cost			8058	8334	8396	8407	0818	8417	8417	8412	8389	8389	8389	8389	8389	8389	8389	8389	8389	8389	8389	8389	838
Maintenance cost			3071	3131	3144	3146	3097	3148	3148	3147	3142	3142	3142	3142	3142	3142	3142	3142	3142	3142	3142	3142	3147
Total costs	0	0	13529	73529 13364 11539 11553 11277 11566	11539	11553	11277	99511	11565	11559	11531	11531	11531	11531	11531	11531	11531	11531	11531	11531	11531	11531	11531
Residual value																				· · · · · ·			
Cash flow	0	0	13529 -	0 0 -73529 -13364 -11539 -11553 -11277 -11566	11539 -	11553 -	11277	1	-11565	-11559 -11531		-11531 -11531		-11531	-11531 -11531 -11531 -11531	11531		-11531 -11531	-11531	-11531 -11531	-11531	-11531	-11531

YEAR	1661	8661	6661	2000	2001	1997 1998 1999 2000 2001 2002 2003 2004	2003	2004	2005	9002	2002	2008	5000	2009 2010 2011	2011	2012 2013		2014	2015	9107	2017	2018	2019
Infrastructure investments																	ļ						
Rolling stock investments			00059	1300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	ت
Operation and energy cost			898	9221	2006	9940	9166	1063	98601	11346	11692	11692	11692	11692	1692	1692	11692	11692		11692	11692	11692	6911
Maintenance cost			3207	3322	2 0 2 0	3477	3472	3626	3703	3780	3855	3855	3855	3855	3855	3855	3855	3855	3855	3855	3855	3855	3855
Total costs	0	С	76894	14443	13008	76894 14443 13008 13417 13388 14257	13388	14257	14680	15127	1	15546	15546	15546	5546	15546	15546	15546		15546	15546	15546	15546
Residual value				-							-												
Cash flow	0	0	-76894	-14443	-13008	0 -76804 -14443 -13008 -13417 -13388 -14257	13388		-14680	-15127	-15546	- 15546	15546	-15546	-15546	15546	15546	15546	-14689 -15127 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546 -15546	-15546	-15546	15546	-15546



CHAPTER 4

Economic assessment of investments

4.4 Cash flow (case with electrification)

Pessimistic scenario

61	160	8661	6661	2000	1997 1998 1999 2000 2001 2002 2001	2002	2003	3 2004	2005	2006 2	2007 2008	2008	2009	0102	1102	2012	2010 2011 2012 2013 2014 2015 2016 2017 2018	2014	2015	2016	2017	2018 2	2019 2	2000
0 92000	92000	į	-				-																	
			691	691	691	691	691	691	169	691	691	691	691	691	169	169	169	691	169	169	169	169	691	169
<u>.</u>	<u> </u>	3	0000	c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			066	2054	2068 2071	2071	2018	2073	2073	2072	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067	2067
			1920	1957	1965 1966 1936	9961	1936	8961	896	1961	26			<u>8</u>	<u>1</u> 86	<u>8</u>		1961			198			8
0 92000 64079 4180 4203 4207 4123	9 00076	9	4079	4180	4203	4207		4210	0174	420	2	2	202	4200	₿		92						1	4200
		- 1																					7	27600
0 -92000 -64079 -4180 -4203 -4207 -4123 -4210 -4210 -4208 -4200 -42	00026		64079	4180	4203 -	4207 -	4123 -	4210 -	4210	4208	-4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	4200	1200	8

-216617

YEAR	1997	1997 1998 1999 2000 2001 2002 2003 2004	1999	2000	2001	2002	2003		2005	2006	2007	2008 2	2009 2	2010	2011 2	212	2012 2013 2014	14 20	2015 2016		2017 20	2018 2019	19 2020	S
Infrastructure investments	0	00076										-				-			-		-	-		
Infrastructure maintenance			691	691 691	691	691	691 691	691	691	691	691	991	691	691	169	691	691	691	1 691	1 69	<u> </u>	69	96	691
Rolling stock investments			00069	2759	0	0	С	0	0	0	0	0	0	0	0	0	0	0	0	0				. 0
Operation and energy cost			2136		2349	2260 2349 2427 2422	2422	2588	2671	2754	2835	2835	2835 2	2835	2835 2	2835 2	2835 28	2835 28	2835 28	2835 28	2835 28	2835 28	2835 28	2835
Maintenance cost			200H	2076 2128 2173 2170	2128	2173	2170	5266	2314	2363	2409	2409	2409 2											2409
Total costs	0	92000 67310 7264 4646 4770 4761	67310	7264	4646	4770	4761	5024	5154	5286	\$413	5413	5413 5	5413	5413 5	5413 5	5413 5	5413 54	5413 54		X 13 S	1		\$413
Residual value												··•··			-								4	20
Cash flow	0	0 -92000 -67310 -7264 -4646 -4770 -4761 -5024	-67310	-7264	97-97	-4770	4761		515	5280	\$413	8413	213	\$413 -:	3413 -5	413 -5	413 -5	413 -5	113 -51	13-51	13-51	13 -54	13 420	-5154 -5286 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 -5413 42006 -224579



5. Global project

5.1 Table of costs (base case)

Pessimistic scenario

YEAR	6661	2000	1007	2002	2003	2004	2005	2006	2007	1 2002	2009	1010	1000				
TKBR passengers (000)	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	611700	1200	000219	7107	000017	1000	2013
FKBR freight Mekhnat-Khavast-Ozhizak (000)	2088875	2252890	2264654	2262322	2187125	2254062	2248283	2232992	2211076	2213076	2213076	22712	2201166	013200	013200	007510	007519
IKBR freight Mekhnat Dzhrzak (000)	271010	1035775	1044120	1045470	1010812	10.16.175	10.15608	1042088	1010117	1036117	2119101	0/06122	1016117	2213070	9/06/77	9/05/27	920177
TKBR passengers (000)	163520	163520	163520	163520	163520	163520	163520	163520	161520	163520	163520	063631	163570	7110501	1119601	1036117	/
IKBR freight Djambai-Marakand (000)	970524	1017210	1017532	1011930	978589	999922	993558	986489	977404	977404	077700	02720	011404	02220	075501	163520	163320
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	861955	863955	861055	90176	977404	404/76	977404
TKBR freight Marakand-Bukhara (000)	4346785	4529620	4570771	4578296	4427750	4585260	4585019	4581751	4566174	4566174	4566174	4566174	4566174	1566174	863933	803933	863933
No TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	2,000	10014	470001	1000
N° TRAINS Freight electric (un)	4578	4938	4962	4956	4791	4935	492	4887	4842	4842	4847	4843		07701	0770	07701	07701
No TRAINS Freight diesel (un)	3410	3606	3633	3636	3515	3635	3631	3618	1596	1596	1596	7 6 0 5 1	7404	7 8 9 8	7 7 7 7	7847	4842
N° TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	102201	10220	0000	0000	0666	3396	9666	3596	3596
N° TRAINS Freight diesel (un)	10764	11279	11276	11208	10839	11065	06601	90601	080	07701	07701	07701	0770	07701	10220	10220	10220
No TRAINS Passengers (un)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	00901	00801	00801	00801	080
N° TRAINS Freight diesel (un)	5594	5829	5882	1685	8698	2900	2900	5895	5874	5874	5874	5874	5874	0770	03/0	02/0	02.0
TRAIN-KM Passengers (000)	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1236	1226	1336	700	700	28/4
TRAIN-KM Freight electric (000)	781	7.5.1	754	753	728	750	748	743	736	736	736	736	212	716	9771	9771	977
TRAIN-KM Freight dieset (000)	107	Ĩ.	917	410	422	436	430	434	432	432	432	432	432	413	7.70	000	9 ;
TRAIN-KM Passengers (000)	127	127	327	127	327	127	327	327	327	327	327	127	127	111	107	764	7 5 6
TRAIN-KM Freight diesel (000)	7	361	191	159	147	354	352	349	346	346	346	346	146	775	346	776	776
TRAIN-KM Passengers (000)	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1778	1778		0 * 0
TRAIN-KM Freight diesel (000)	1471	1533	1547	1549	1498	1552	1552	1550	1545	1545	1545	1545	1545	1545	\$45	373	377
10000	0	0	0	0	0	0	0	0	o	c	0	-					-
Total needs	9	9.	4.7	47	4.7	4.7	47	47	47	4	47	74	2 5	,	5 (٠;	; ٥
Needs diesel	~	4.2	7	113	42	7	43	4	4.2	4,	4	7	; ;	: :	. :	<u>, ;</u>	
Needs electric	7	7	4	7	4	7	7	4	4	4	. 4	7 7	7 7	7,	7,	7,	7,
Diesel fleet	0	4.2	4.2	43	43	43	43	4 3	43	43.	7.7	43	* *	7 ;	7 ;	• ;	• ;
Electric fleet	0	4	**	7	7	4	4	7	7	7		; `	7	-	<u>.</u>	-	<u>.</u>
Investment diesel	4.2	0	_	0	0	0	-0	. 0		, c	7 0	• 6	7 0	7	4 (- -	.
Investment electric	•	0	0	0	0	0	0	0	0	C	· c	0	0 0		0 0	5 6	5 (
INVESTMENTS (000)	121200	9	2600	,	0	*	*	0	n	-	, ,	, ,	2	2	•		· •
Energy costs (diesel)-000	11579	96611	12068	12073	11754	12067	12056	12036	16611	16611	16611	16611	1 6611	10011	10011	1001	
Energy costs (electricity)-000	159	707	106	705	682	703	101	969	9	069	069	069	069	069	069	069	1661
Operating costs diesei	787	801	804	108	793	803	803	802	800	800	800	800	800	000	000	000	
Operating costs electric	68	46	44	4.5	16	96	96	3.6	9.5	9.8	9.6	9.8	9.5	0	**		200
OPERATING COSTS (000)	1.1106	13595	13675	13679	13322	13669	13656	13630	13576	13576	13576	13576	1.3576	11576	11876	72321	32.32
Maintenance costs diesel (000)	286	5384	4400	1015	1127	5 3 9 K	5196	0615	5370	5379	5379	5379	\$179	\$179	\$130	0713	0,72
Maintenance costs electric (000)	170	0.1		1.2	7 8 +	0,0	? ! !	21:	77	44.2	442	~ ~	7 + 7				
MAINTENANCE COSTS (nou)	\$756	18.84	5853	5853	1925	8 3 4 #	5811	5836	1288	5 # 2 1	5821	5821	3821	5821	5821	17.75	183
101.11.	14001	19429	12117	19531	19086	19517	19500	19465	19397	19397	19397	19397	19397	19397	19397	19397	19397
Residual Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	c	c	٠
Diesel	17472	o	624	0	O	0	0	0	0	0	0	0	0	o		, c	
Electric	1600	C	0	0	0	0	0	£	5	O	0	c					
												,	,	,	,	>	•



TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

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chiminal accuming																	
YEAR	6661	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TKBR passengers (000)	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200
TKBR freight Mekhnat-Khavast-Dzhizak (000)	2289501	2545835	2653625	2748297	2739708	2941851	3040829	3129802	3214476	3214476	3214476	3214476	3214476	3214476	3214476	3214476	3214476
IKBR freight Mekhnat-Dzhizak (000)	1073541	1170457	1224452	1272046	1368101	1369103	1419215	1466577	1511860	1511860	1511860	1511860	1511860	1511860	1511860	1511860	1511860
TKBR passengers (000)	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520
TKBR freight Djambai-Marakand (000)	1063703	1149445	1201168	1247448	1243853	1342885	1392107	1441707	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1489797
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955
ITKBR ficight Marakand-Bukhara (000)	4764098	5118:143	5372517	5595724	5579820	6054207	6289759	6528701	6757886	6757886	6757886	6757886	6757886	6757886	6757886	6757886	6757886
Nº TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220
N° TRAINS Freight electric (un)	5017	5580	5815	6021	6002	6442	8599	6852	7037	7037	7037	7037	7037	7037	7037	7037	7037
No TRAINS Freight diesel (un)	3738	4075	4262	4426	4412	4762	4934	\$605	5254	5254	5254	5254	5254	5254	5254	\$254	5254
No TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220
N° TRAINS Freight diesel (un)	11797	12745	13316	13827	13787	14881	15425	15972	16503	16503	16503	16503	16503	16503	16503	16503	16503
N° TRAINS Passengers (un)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570
N° TRAINS Freight diesel (un.)	6131	6587	6914	7201	7181	7792	8095	8402	8697	8697	8697	8697	8697	8697	8697	8697	8697
FRAIN-KM Passengers (000)	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226
TRAIN-KM Freight electric (000)	858	848	884	915	912	626	1012	1042	1070	1070	1070	1070	1070	1070	1070	1070	1070
TRAIN-KM Freight diesel (000)	449	489	= 5	531	529	175	592	612	631	631	631	631	631	631	631	631	631
TRAIN-KM Passengers (000)	327	327	327	327	327	327	327	327	327	327	327	327	327	327	327	327	327
[TRAIN-KM Freight dieset (000)	378	408	426	442	44	476	404	511	528	528	528	528	528	528	528	528	528
TRAIN-KM Passengers (000)	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728
TRAIN-KM Freight diesel (000)	1613	1732	1818	1894	1889	2049	2129	2210	2287	2287	2287	2287	2287	2287	2287	2287	2287
T0C08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
Total needs	48	64	5.1	52	52	54	95	57	57	57	5.7	57	57	57	57	\$7.	57
Needs diesel	43	45	46	47	46	48	49	90	51	5.	\$1	15	15	- 5	21	-5	51
Needs electric	7	4	4	٠,	5	s	2	5	5	5	\$	~	3	~	~		
Diesel fleet	9	43	45	96	47	47	30	67	20	5.1	5	5.1	5.	3	- 5	- 5	5.1
Electric fleet	0	7	4	7	5	5	S	2	\$	5		•	3		~	~	
Investment diesel	43	2	-	_	0	-		_	_	0	0	0	0	0	0	-0	0
Investment electric	*7	0	0	_	0	0	0	0	0	0	0	0	0	0	0	0	0
INVESTMENTS (000)	123800	8200	2600	3600	0	2600	2600	2600	2600	0	0	0	0	0	0	0	0
Energy costs (diesel)-000	12460	13244	13769	14231	14197	18181	15669	65191	16630	16630	16630	16630	16630	16630	16630	16630	16630
Energy costs (electricity)-000	714	794	827	857	854	917	048	976	1002	1002	1002	1003	1002	1002	1002	1002	1002
Operating costs diesel	817	844	862	878	877	911	928	945	196	196	196	196	196	196	196	196	196
Operating costs electric	86	109	1 = 1	<u>8</u>	117	126	130	134	138	138	138	138	138	138	138	138	138
OPERATING COSTS (000)	11089	16611	15572	16084	16015	17135	17675	18214	18730	18730	18730	18730	18730	18730	18730	18730	18730
Maintenance costs diesel (000)	1615	5674	3796	5903	5895	6123	6236	6349	6458	6458	6458	6458	6458	6458	6458	6458	6458
Maintenance costs electric (000)	\$15	5005	530	8:19	2.17	588	607	625	642	642	642	6-12	643	642	642	642	642
MAINTENANCE COSTS (000)	9009	6183	6.326	6452	7119	0711	6.4.3	1269	7100	2100	7100	2100	2100	2100	7100	2100	7100
TOTAL	143895	26374	24198	28136	22488	26446	27119	27788	28430	25830	25830	25830	25830	25830	25830	25830	25830
Residual Value	С	0	0	0	0	0	0	0	0	0	0	С	0	0	0	•	°
Diesel	17888	10.40	624	728	0	986	1040	1144	1248	0	0	0	0	0	0	0	0
Electric	3600	9	=	1200	0	0	0	0	0	9	0	0	0	0	0	0	0



CHAPTER 4

Economic assessment of investments

5.2 Table of costs (case with electrification)

Pessimistic scenario

l'essimistic scenario																	
YEAR	6661	2000	1007	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
TKBR passengers (000)	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200
IKBR fieight Mekhnat-Khay ast-Dzhizak (000)	1465877	0260851	1589231	1587595	1534965	1581798	1577743	1567012	1553036	1553036	1553036	1553036	1553036	1553036	1553036	1553036	1553036
IKBR freight Mekhnat-Dzhizak (000)	979475	1015775	1044120	1045470	1010832	1046175	1045608	1042088	1036117	1036117	1036117	1036117	1036117	1036117	1036117	1036117	036117
IKBR passengers (000)	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520
I.S.B.R. (length Diambar-Marakand (000)	970524	1017210	1017532	1011930	978589	999922	991558	086489	977404	977404	977404	977404	977404	977404	977404	977404	977404
TKBR passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955
TKBR freight Marakand-Bukhara (000)	1116785	4529620	4570771	4578296	4427750	4585260	4585019	4581751	4566174	4566174	4566174	4566174	4566174	4566174	4566174	4566174	4566174
No TRAINS Passengers (un)	10220	10220	10220	10220	10220	16220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220
No TRAINS Freight electric (un.)	4578	4938	4962	4956	4791	4935	4921	4887	4307	4307	4307	4307	4307	4307	4307	4307	4307
No TRAINS Freight electric (un)	3410	3606	3633	3636	3515	3635	3631	3618	3596	3596	3596	3596	3596	3896	3596	3596	3596
No TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220
No TRAINS Freight electric (un)	10764	11279	11276	11208	0830	11065	06601	90601	00801	10800	10800	10800	00801	10800	10800	10800	10800
No TRAINS Passengers (un)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570
No TRAINS Freight electric (un.)	5594	5829	5882	1685	8698	\$ 900	2900	5885	5874	5874	5874	5874	5874	5874	5874	5874	5874
TRAIN-KM Passengers (000)	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226	1226
TRAIN-KM Freight electric (000)	783	151	754	753	728	750	748	743	655	655	655	655	655	655	655	655	655
TRAIN-KM Freight electric (000)	601	433	436	436	422	436	436	434	432	432	432	432	432	432	432	432	432
IRAIN-KM Passengers (000)	327	327	327	127	327	327	327	327	327	327	327	327	327	327	327	327	327
TRAIN-KM Freight electric (000)	344	361	361	359	347	354	352	349	346	346	346	346	346	346	346	346	346
TRAIN-KM Passengers (000)	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728	1728
TRAIN-KM Freight electric (000)	1471	1533	1547	1549	1498	1552	1552	1550	1545	1545	1545	1545	1545	1545	1545	1545	1545
LOCOS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total needs	<u>.</u>	3.2	32	32	31	32	32	3.2	3.1	31	31	31	31	3.1	31	31	3.1
Needs diesel	0	0	С	0	0	0	c	0	С	0	0	0	0	0	0	0	0
Needs electric	-	3.2	32	3.2	31	3.2	3.2	3.2	31	3.1	3.1	3	3.1	31	3.	31	31
Diesel fleet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flectric fleet	0	31	3.2	32	32	3.2	3.2	3.2	32	3.2	3.2	3.2	3.2	32	32	32	32
layestment diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
lovestment electric	31		0	0	0	0	0	0	0	0	0	0	0	0	0	0	٥
INVESTMENTS (000)	93000	3000	*	9	0	0	0	0	0	0	0	•	0	0	0	0	0
Energy costs (diesel)-000	С	0	0	С	С	c	0	С	0	c	o	С	0	0	0	o	0
Energy costs (electricity)-000	2931	3056	3074	3074	2990	3071	3068	3060	3046	3046	3046	3046	3046	3046	3046	3046	3046
Operating costs diesel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating costs electric	692	700	1117	111	700	710	710	709	669	669	669	669	669	669	669	669	669
OPERATING COSTS (000)	3623	3765	3785	3785	3690	3782	3778	1769	3746	3746	3746	3746	3746	3746	3746	3746	3746
Maintenance costs diesel (000)	Ç	¢	С	0	C	ċ	c	Ċ	c	0	0	С	0	o	0	0	_
Maintenance costs efective (000)	1171	51.81	8 Z 8 +	1827	1766	183.1	1821	181	1733	1755	1755	1755	1755	1755	3755	3755	3755
MAINTENANCE COSTS (000)	3773	3 1 8 1 5	3828	3827	3766	3.824	3821	3813	3755	3755	3755	3755	37.55	37.55	37.55	3755	3755
TOTAL	100396	10580	7613	7613	7456	9092	7599	7583	7501	7501	7501	1801	1801	7501	1801	1801	7501
Residual Value	0	0	С	С	С	О	0	С	0	С	0	С	0	0	0	0	0
Diesel	0	С	0	=	0	c	0	0	c	С	0	С	C	0	0	0	0
Electric	27900	1000	9	\$	=	0	0	C	0	0	0	0	C	0	0	0	0



Module B: Uzbekistan

.. FINAL REPORT CHAPTER 4

Economic assessment of investments

Optimistic scenario

VEAR	6661	2000	1007	2007	1001	1006	2000	,000									
1 K B R passengers (000)	613200	613200	007519	002219	2300	13700	5007	0007	/007	8007	2009	2010	2011	2012	2013	2014	2015
TKBR freight Mekhnat-Khayast-Dzhigal (1100)	16.06.66.7	1797651		007510	007110	002410	013500	613200	613200	613200	613200	613200	613200	613200	613200	613200	613200
JKBR freight Mekhnar Dzhizak (000)	1073541	1170157	1331160	6709761	7,007761	2064457	2133915	2196352	2255773	2255773	2255773	2255773	2255773	2255773	2255773	2255773	2255773
TKBR passenvers (000)	16.36.30	7040711	204477	0.02721	1018971	1369403	1419215	1466577	1511860	1511860	1511860	1511860	1511860	1511860	1511860	1511860	511860
TKBR freight Diambai Mand and ones	0.5050	070001	076601	076501	075591	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	163520	063530
TERD TO THE PART OF THE PART O	1003/03	1149445	1201168	1247448	1243853	1342885	1392107	1441707	1489797	1489797	1489797	1489797	1489797	1489797	1489797	1480707	07.00
I was passengers (000)	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	863955	250178	963056	220620	1717061	14041	16/604
FN BK Beight Manakand Bukhana (000)	476 109 X	5118443	5372517	5595724	5579820	6054207	6289759	6528701	6757886	0.757886	7686567	70000	26,500	003333	803935	_	863955
No TRAINS Passengers (un)	10220	10220	10220	10220	10220	10220	10220	10220	0000	0000	000/6/0	0001610	099/0/0	0 / 2 / 8 8 6	6757886	_	6757886
No TRAINS Freight electric (un)	5017	5580	5815	000	6009	6143	02701	0770	02201	0220	07701	10220	10220	10220	10220	10220	10220
Nº TRAINS Freight electric (un)	373K	4075	4767	1430		1 1 1 1	9000	0832	/03/	7037	7037	7037	7037	7037	7037	7037	7037
N. TRAINS Passengers (un.)	0000	0,00	2024	0747	7 - 7 - 7	79/7	4934	8605	5254	5254	5254	5254	\$254	5254	5254	5254	5254
No TD A INC Electric Company	02201	07701	07701	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	10220	1020
No To Anna Height electric (un.)	/6/	12745	13316	13827	13787	14881	15425	15972	16503	16503	16503	16503	16503	16503	16603	27701	07701
N IRAINS Passengers (un)	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6570	6550	0000	5050	1000	10503	16503
N° TRAINS Freight electric (un)	6131	6587	6914	7201	7181	7792	8095	8402	8607	6607	0.00	0.00	02.00	07.0	0/69	6570	6570
TRAIN-KM Passengers (000)	1226	1226	1226	1226	1226	1226	1736	2010	7609	7600	/608	/698	8697	8697	8697	8697	8697
TRAIN-KM Freight electric (000)	858	878	884	\$10	013	070	0771	0771	0771	9771	1226	1226	1226	1226	1226	1226	1226
TRAIN-KM Freight electric (000)					717	6/6	7101	1042	1070	1070	1070	1070	1070	1070	1070	1070	1070
TEAN INTERPRETATION	7	60	-	531	529	173	592	612	631	631	631	631	631	631	631	631	
TATION OF THE STATE (CO.)	327	327	327	327	327	327	327	327	327	327	327	327	127	227			100
KAIN-KNI Freight electric (000)	378	807	426	4:12	141	476	194	311	828	\$28	636	1 1	770	327	176	175	327
(RAIN-KM Passengers (000)	1728	1728	1728	1728	1728	172X	1728	1738	17.5	27.	070	0.70	278	228	528	528	528
TRAIN-KM Freight electric (000)	1613	1732	818	894	088	0200	2130	27.1	17.28	1/28	1728	1728	1728	1728	1728	1728	1728
1.0008	6					200	717	0177	7877	7877	2287	2287	2287	2287	2287	2287	2287
Total needs	; ;		2	٠,	o ;	0	0	0	0	0	0	0	0	0	0	0	c
, , , , , , , , , , , , , , , , , , ,	5 6	34	C F	35	35	3.7	38	38	39	39	39	39	39	30	30	0.0	,
Nacio di con	5	0	0	0	0	0	0	0	0	0	0	-0	c	, -	,	3	Š.
אכנתי כובנונונ	33	34	35	3.5	35	3.7	38	38	39	39	3.0	30	02	,	- ;	> (D ;
Diesei fleei	5	0	0	0	0	0	0	0	3		1	,	96	٧٤	95	39	39
Electric fleet	С	33	34	35	35	35	3.7	×	, or	30	2 (9	0	O ;	0	0	0
Investment diesel	O	0	0	0	0	C		0	9 0	, o	66	99	39	39	39	39	39
Investment electric	33	_		0	0	,) =	0 0	- -	0 0	0 (-	0	0	0	0	0
INVESTMENTS (000)	00066	3000	3000	0		0009	3000	•	- 5000) ;	5 (<u>-</u>	-	0	-	0	0
Energy costs (diesel) 000	С	0	0	٥	=			3 9	anne	a	0	0	0	0	0	0	•
Energy costs (electricity)-000	3163	3387	3522	16.47	3633	, K	20.0			0 ;	С	c	0	0	0	0	0
Operating costs diesel	0	0					0 0	7	4230	4726	1256	1256	4256	4256	4256	4256	4256
Operating costs electric	723	752	770	78.5	787	0	9 :	0 5	<u> </u>	0	0	0	0	0	0	0	0
OPERATING COSTS (000)	7 X X ?	02/7	6303	6637		, 10	400	820	698	865	865	865	865	865	865	865	865
Maintenance costs diesel (000)			7.1	\ 7 + +	,	50/7	184	4987	5122	5122	\$122	5122	5112	\$122	5122	5122	\$122
Maintenance costs electric (000)	7017	9 9 9		2 ;		9	0	0	0	0	0	0	0	0	0	0	c
MAINTENANCE COSTS (MAIN)	2007			8 1 1	757	=	505	4593	1678	4678	1678	4678	4678	1678	1678	1678	1678
	1446	4033		12.18	12.12	7177	1505	1393	1678	4678	1678	1678	4678	3678	1678	1678	14.78
TOLAL	106832	11194	11445	8666	8649	15119	12352	1856	12800	9800	0800	0086	0000	0000		9/04	0/07
Residual Value		С	0	0	0	0	0		=			رومر	7000	2000	9800	9800	9800
Diesel	0	0	0	0	0	0		0 0	•	0 0	o (0	0	0	0	0	0
Electric	29700	1000	9911			9000	0 000)	9	•	0	0	0	0	0	0	0
					2	100	1200	0	1700	0	С	C	c	=	0	0	0
									!							,	,



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

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

CHAPTER 4

Economic assessment of investments

5.3 Cash flow (base case)

Pessimistic scenario

VEAD	1000	1	385	1000									-		}									
rEAK	/661	8761	1997 1998 1999 2000 2001 2002 2003 2004 2005		1 000	2002	2002	500	2005	2006 2007		2008	2009	2010	2011	2012 2013 2014	013	714	2015 2016	147	2017 3010	010		Ī,
Infrastructure investments	Ş													-	-		3		3	2	<u> </u>	JIO OIL	2020	- -T
Rolling stock investments	·		121300	2	300	C	C	<u> </u>	0	0	==	3	0	<u> </u>	_									
Quation and energy exist	<u>.</u>		13106	13595	13675	13679	13679 13322 13669	1366	13656	13630	13576		13576			13576 1	1576	3576				12 27 28 20 20 20	<u>را</u> ح	5
Muirterence cost			5756	5834	5853	5853	5764	2848	5 84	5836	2821	5821	2821	5821	\$	1085		282	20/25	20/27	20/22	20/00/	0/05/ 0/05/	0 -
Total costs	0	0	140061 19429 22127 19531 19086 19517 19500	19429	2127	19531	98061	19517	00561	19465	19397			1		10307	10307	17000	10001	- 11		7 5		
Residual value								_										1 // //	21 // (2)			19591 19591	19891	<u> </u>
Cash flow	2	2	0 1400K 10100 10501 10501 100K 10500	50.5	313	1553	1000	10617	10700	20,00	1000					+	-	1	\dashv	-	-		•	لو
	5	5	1	1247	77.77	ICCKI	2000	181	mcki	- 200	-1/6561	- 1939/1-	19397	19397	19397	-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/1-1939/	3397 - 1.	9397 -1	397 -19	<u>397</u> -19	<u> 397 -19</u>	397-193	1	2299 -578587
																				-	1		П	

Spinnishe seemano																								
YEAR	7661	1998	1997 1998 1999 2000 2001 2002 2003 2004 2005	2000	1002	2002	2003	H007	2005	2006	2006 2007	2008 2009	2009	2010	2010 2011	2012 2013 2014 2015 2016 2017	2013	2014	2015	2016	2017	2010	9	5
nfrastructure investments	S	-																	3	NIO.		2010	200	200
Rolling stock investments	S		123800	2300	009	2009	0	2600	2600	2600	2600	0	0	C			C							(
paration and energy cost	ઝ		14(80)	4(38) 14901	15572	16084 16045	16045	17135	17675	18214	18730	18730	873(18730	\$	02281 05281	873) 2 23	\$ C	0228	2 6	5		3 E
Maintenance cost			9009		6183 6326	6452	6442	11/9	6843	6974	7100	7100	710	7100	81	2012	210	38.5	05/61 05/61 7100 7100	2/01	2,001	3 8		3/%
Total costs	0	0	0 143895 26374 24498 28136 22488 26446 27119	26374	24498	28136	22488	26446		27788 28430	28430	101	25830	25830	25830	25830	25830	25830	25830	25830	25830	25830 25830 25830		7883
Osh flow	1	+	142005	1200	93,50	75.105	3,00						\dashv									-	7	29448
	5	5	61117-107-107-108-77-106107-106-17-166-17-166-11-16	-7007-4 -	0/47	-00.107	2017	940	-/11/7	88//7	05H30	-21/88 -28430 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830 -25830	2830	25830	25830	-25830	25830	25830	25830	25830	25830 -2	25830-2	2830	3618 -661518



5.4 Cash flow (case with electrification)

Pessimistic scenario

						-	-	-	-	-		-	-	-		-	-							ī
YEAR	1997	1997 1998	1999	1999 2000 2001 2002 2003 2004	2001	2002	2003	-	2005	2006 2	2007 2	2008 2	2009 20	2010	2011 20	012 2	013 2	2012 2013 2014 2015	115 20	2016 20	2017 20	2018 2019	9 2020	<u> </u>
Infrastructure investments	0	0 129000																						
Infrastructure maintenance			320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320	320 3	320	320
Rolling stock investments			93000	3000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and energy cost			3623	3765	3785	3785 3690 3782	3690	3782	3778	3769	3746	3746			3746 3	3746 3	3746		` .	3746 3	3746 37	3746 37	3746 3581	
Maintenance cost			3773		3815 3828	3827	3766	3824	3821	3815	3755 3		3755 3								3755 37	3755 37		55
Total costs	0	129000	0 129000 100716 10899 7932 7932 7775 7925	66801	7932	7932	2777	7925	. 816/	7903	7820	7820	7820	7820	7820	7820 7	7820	7820	7820	7820 78			7820 7656	9
Residual value																							67600	0
Cash flow	0	-129000	0 -129000 -100716 -10899 -7932 -7932 -7775 -7925 -7918 -7903 -7820	-10899	-7932	-7932	-7775	.7925	- 816/	7903	7820	0282	0281 - 0281 - 0281 - 0281 - 0281 - 0281	078	028/	;- 028,	028,	0281 - 0281 - 0281 - 0281 - 0281 - 0281	7- 028	820 -28	<u>17-</u> 023	8Z- 0Z3	20 59944	4 -329720
																					ŀ			

1999 2000 2001 2002 2003 2004 2005
320 320 320 320
3000 0000 0000
1139 4292 4427 4417
4055 4153 4238 4232
129000 107152 11514 11764 8985 8968 15439 12671
7-12000 -107152 -11514 -11764 -8985 -8968 -15439 -12671





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5. Operations and Traffic analysis

5.1 Introduction

Traffic forecasts are particularly difficult to produce in countries where transformations are taking place and where there is still uncertainty on when economic recovery will start and which form it will take.

Road transport is expected to benefit more in the event of an economic recovery than rail transport. Therefore it wouldn't be pragmatic to consider that traffic will recover the figures of the 80's. Nevertheless the objective was here to calculate realistic forecasts taking into account figures produced by the Traffic database report and the main anticipated outlines of market share for each type of product.

5.2 Method

Traffic statistics, as in nearly all republics which were formerly part of the Soviet Union, are not available under the format of O/D matrix. The main source which may be used lies in data by section of line and global data. Therefore data which have been used, was drawn from these statistics. They include:

- distance
- travel time
- tonnage carried
- number of trains
- · ton-km carried
- average load per train
- breakdown of tonnage by type of commodity.

This limitation in terms of data availability does not produce any strong hindrance in the calculation of traffic forecasts. Conversely it does not help in determining a sensible transport plan.

After these data for 1996 were collected, an economic scenario was designed. This has been done using two sources:

- the Institute of World Economics for determining the evolution of the production of certain type of major commodities,
- the traffic database report for TRACECA area. The outputs used from this report concerns mainly the evolution of the GDP and the trade growth. The scenario considered is the middle one

Once the traffic per section and the production growth are known, it has been considered that the evolution of freight traffic on each commodity is correlated to the production growth. Two scenarios were then considered:

- a high scenario, where railway traffic was assumed to be kept roughly at a similar level to those of today (except for some commodities such as "others" category where a development of road transport share has been considered).
- a low scenario where rail traffic share was assumed to reduce of around 2% per year for the majority of commodities (including these which are traditionally carried by rail) and 4% for the remaining ones (in particular high value added goods).

Another parameter has been added: the reduction of average distances and average load per train. The evolution of the national economy is having the following effects:

- reduction of international traffic (imports, exports, transit), in particular when comparing to Soviet Union times. As an example Uzbekistan has increased its refinery capacity in such a way to be independent. Therefore there will be less traffic between Uzbekistan and Kazakhstan.
- reduction of national distances. Here again petrol products are a good example. The
 construction of the new refinery near Bukkhara allows for refining the petrol extracted on
 site. Transport of crude petrol (in terms of ton-km) will thus be reduced. The development
 of the economy should lead also to develop industries nearby production sites in order to
 limit transportation costs.
- reduction of average load. Heavy loaded train number will reduced due to the evolution of the economy where light but high value goods volumes will progressively increase. Also the development of industries which main activity will be to treat basic products (cotton. petroleum, grain, ...).

Statistics used are from two sources:

- the railway provides traffic statistics per section and overall per type of commodity;
- breakdown by type of commodity and per section has been obtained using the data produced in the report on traffic database. Because overall values were significantly different to these of the railways it has been decided to use them in terms of percentage applying to railway figures.

Even if considering that Traffic Database Project figures are for 1995 when railway figures are for 1996, differences are significant. On the following table is shown a sample of the results produced.

Comparison of Traffic Database Report and Railways statistics data

Section	DIFFERENCE	ATKINS	RAILWAYS
Chengeldy-Uzbekistan	20%	11 447	14335
	27%	5 167	7084
Dzizak-Khavast	1%	9886	10003
	20%	6462	8115
Mekhnat-Khabast	-27%	9934	7805
	4%	5582	5807
Dzizak-Marakan	-45%	15385	10 612
	-51%	13000	8601
Bukhara-Karchi	-213%	6160	1965
	19%	2358	2923
Angren-Kizil Tukmachi	-87%	5178	2769
	-30%	2700	2081
Salar-Khadjikent	-6%	630	593
	-25%	946	759
Uchkuduk-Navoi	-133%	1761	757
	-13%	905	800
Nukus-Kumshungul	-280%	528	139
	-253%	60	17
Kitab-Karshi	-10%	1597	1455
	-39%	866	622
Amuzang-Termez	-547%	576	89
	-121%	450	204

Overall, on this sample, these statistics are about 20% higher than railway ones. The main reason for such high difference is coming from the statistics on Dzhizak-Marakand section.

5.3 Economic overview

The following tables show the expected evolution of trade and economy growth in each central Asian country.

Table no 5.3.1: trade and economic growth in Central Asia Trade Growth 1996 1997 1998 1999 2001 2002 2000 2003 2004 2005 2006 2007 Kazakstan 0,6 1.64 4.47 7.45 7.45 8.2 9.68 9.68 9.68 9.68 9.68 9.03 Kyrgyzstan 3.58 7.9 8.05 8.2 8.34 8.34 7.74 7.74 7.74 7.74 7.74 5.16 Tadjikistan 10.43 0.45 5.36 6.11 6.11 6.11 3.87 3,87 3.87 3.87 3.87 3.87 Turkmenistan 5,51 2.98 2.98 2.98 2.98 2.98 4.52 4.52 4.52 4,52 4.52 4.52 Uzbekistan 1.49 0.75 4.52 4.52 5.22 4.52 3.87 4.52 4.52 2.40 2.20 2.00 1.80 Kazakstan Kyrgyzstan 1.60 Tadiikistan Turkmenistan 1.40 Uzbekistan 1.20 1.00 8 666 2002 8 88 800 8 200 **Economic Growth** 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 Kazakstan 0.4 5.5 7.5 7.5 Kyrgyzstan 5.3 5.5 5.6 5.6 6 6 6 6 6 Tadjikistan 0.3 3.6 4.1 4.1 4.1 3 Turkmenistan 3.5 Uzbekistan 0.5 3.5 3.5 3.5 1.80 1.70 1.60 Kazakstan Kyrovzstan 1.50 Tadjikistan Turkmenistan Uzbekistan 1.30 1.20 1.00 8 2002 2008 8 8 2007

It must be noticed that the five central Asian countries may be classified in terms of development into two categories:

- category one where the expected economic and trade growth is relatively high; it includes Kazakhstan and Kyrghystan
- category two where both economic and trade growth are low and quite linear; it includes Tadjikistan, Turkmenistan and Uzbekistan.

Following the split of the Soviet Union, most of the Republics created, including the Republic of Uzbekistan, had to face a strong economic recession (as shown in the table underneath).

Since then, Uzbekistan had undertaken a reform process which is having a positive impact: the rate of decline of the Uzbek economy is decreasing in such a way that GDP growth is expected for 1997 and the years to come. Privatisation processes are still going on.

5.4 The transport sector

The Uzbek transport system and its organisation have been severely hit by the lack of maintenance.

The new economic policy based on the application of free market principles should stimulate internal and foreign trade of the country and will require alternative and efficient transport routes both for goods and passenger traffic. Transportation market should therefore be modified drastically, with a significant increase in the motorisation rate and the development of bus transportation.

For freight transportation, the traffic share is relatively steady in terms of tons-kilometres carried (see underneath charts). Railway (-8%) share was reduced when road (+8%) and others (+90%) have increased significantly in a six years period. Considering the emergence of a private road transport sector, the strong influence of foreign road transport companies, the degradation of the rail services, railways are resisting unexpectedly well.

On passengers the situation is more complicated: after having gained market share in a rapidly falling market between 1990 and 1995, the situation reversed in 1996 when rail market share started to go down and bus transport sector was increasing its level of passengers kilometres. This trend should not change unless services in train are improved: clean and comfortable rolling stock, improved commercial skills of the on-board staff, reduction in travel times.

Table no 5.4.1: Traffic share for freight (in billions tons/km)

			FREIGHT	***************************************	***************************************	***************************************
····	MA	RKET SH	ARE	0000000000000000000000000000000000000	VOLUMES	990000000000000000000000000000000000000
MODE	1990	1995	1996	1990	1995	1996
Railway	72,4%	67,7%	67,0%	56,90	18,90	17,50
Road	25,3%	28,3%	29,1%	19,90	7.90	7.60
Pipeline	0,3%	0,0%	0,0%	0,20	0.01	0.01
Waterways and air	2,0%	3,9%	3,8%	1,60	1,10	1,00
TOTAL	100%	100%	100%	78,60	27.91	26.11

Source: UTY, 1997

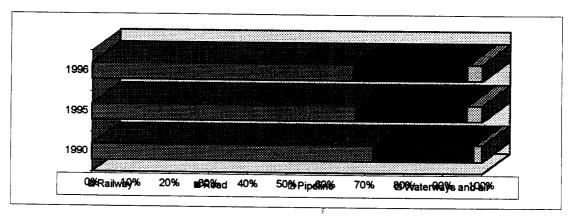
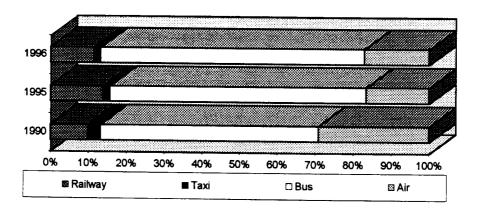


Table n° 5.4.2: Traffic share for passengers (in millions passengers/km)

PASSENGERS										
		SHARE		VOLUMES						
MODE	1990	1995	1996	1990	1995	1996				
Railway	9,9%	13,9%	11,4%	3 900	2 498	1 999				
Taxi	3,3%	1,8%	1,8%	1 300	323	309				
Bus	57,7%	67,8%	69,8%	22 762	12 224	12 244				
Air	29,1%	16,6%	17,1%	11 498	2 984	2 993				
TOTAL	100%	100%	100%	39 460	18 029	17 545				

Source : UTY, 1997



The railways situation is dramatically deteriorating in the benefit of road transportation. The detailed analysis of the figures provided shows that only commuter services are keeping their position, providing social services. All long distance services are reducing considerably:

- intercity,
- international
- transit

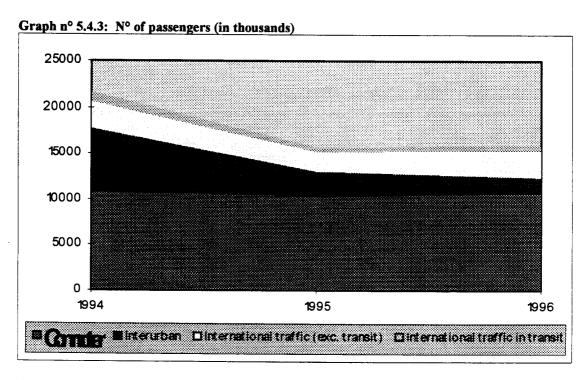
These changes are due to:

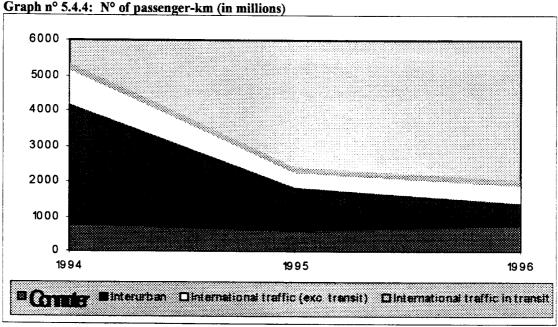
- strong price increase (in 1994): prices multiplied by 2.5
- deterioration of service quality: travel time, on board service, cleanliness
- increase of fraud.

Therefore a 27% drop in the number of passengers carried from 1994 to 1996 and a 62% decrease in passenger kilometres has been observed. Road transport is quicker and cheaper. Increase in railway market share could be reached only with a strong service improvements. Railway are strongly threatened on short/medium distances by car (private car and taxi) and on long distance and international services by plane and buses.

*************************************	······		·····				
	199	4	199	5	1996		
	Passengers	Passkm	Passengers Passkm				
	(in 000's)	(in millions)	(in 000's)	(in millions)	(in 000's)	(in millions)	
Commuter	10,838	785	10.348	571	10.678	726	
Interurban	6,827	3,398	2.634	1.246	1.579	***************************************	
International traffic (exc. transit)	3.026	967	2.228	424	***************************************	643	
International traffic in transit	936	216	512		3,082	493	
TOTAL	21,627	5.366	15.722	156 2.397	498 15.837	167 2.029	
Source LITY 4007			***************************************		13,637	2,029	

Source UTY, 1997

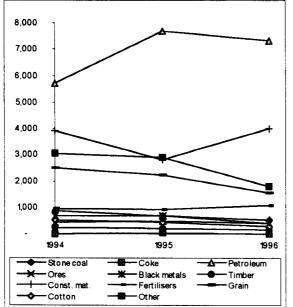


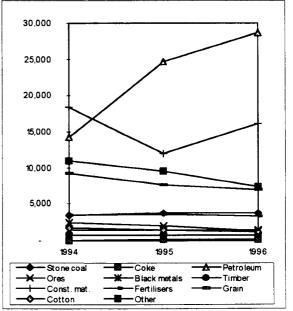


We have considered that the volume of passenger carried will remain at the same level as today.

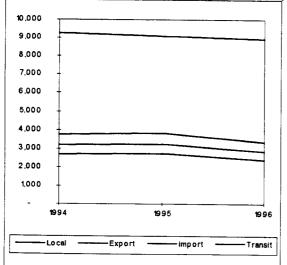
For freight, the situation is improving in terms of tons carried but the average distance has reduced. The reduction of transit and import traffic maybe the main cause.

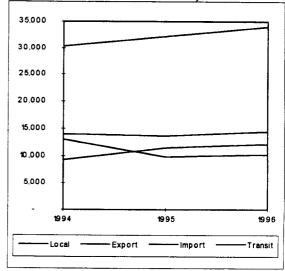
Graph n° 5.4.5: Evolution of rail freight traffic (in million ton/km and thousand tons)











5.5 Definition of the pessimistic scenario

Forecasts for commodity production in Uzbekistan has been drawn from a report produced by the "Institute of World Economics". It is described in the following table:

Commodities	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal (1)	1,00	1,05	1,10	1,72	233	233	233	233	233	233	233	233
Coke	1,00	1,06	1,12	1.48	1.85	1.87	1.90	1.93	1,95	1.98	201	204
Oilandgas (3)	1,00	1,07	1,13	1,25	1,37	1.42	1.47	1.52	1.57	1.63	1.68	1.74
Cres(1)	1,00	1,01	1,02	1.08	1.14	1.17	1.20	1.23	1.27	1.30	1.33	1.35
Black metals (1)	1,00	1,04	1,08	1,11	1.14	1.15	1.17	1.19	1.21	1.22	1.26	1,29
Timber (2)	1,00	1,01	1.03	1.07	1.12	1.18	122	1.27	1.31	1.36	140	1.44
Construction materials (2)	1,00	1,01	1.03	1.07	1.12	1.18	1.22	1.27	1.31	1.36	140	1.44
Fertilisers (1)	1,00	1,07	1,15	1.30	1.45	1.55	1.65	1.75	1.85	1.95	211	228
Grain (1)	1,00	1,03	1.05	1.09	1.13	1.29	1.44	1.59	1.75	1.90	1.98	205
Catton (1)	1,00	1.08	1.16	1.18	1.21	1.21	1 22	1.22	122	1.23	1.24	125
Others (2)	1,00	1.01	1.03	1.07	1.12	1.18	1.22	1 27	1.31	1.36	1.40	مے 1.44

(1) Institute of World Economics

(2) TRACECA "traffic data base" report produced by Atkins - Economic growth in Traceca Countries

(3) TRACECA report on energy produced by Sofresid-Sofremines

The review of past evolution of railway transport has shown the following trends:

- reduction of the overall volumes (mainly in terms of ton-km)
- reduction of international traffic
- · reduction of railway traffic share
- reduction of the average load per train
- reduction of the average distance

A reduction of 2% per year has been assumed for all goods except "others" (4%). It has also been considered that the average distance will be reduced of 20%. And, finally, on top of these 20% antoher 10% reduction has been applied to petroleum products applying mainly in the first five years. This is due to the development of raffinery close to extraction sites.

5.6 Definition of the optimistic scenario

5.6.1 Freight

Rail traffic share has reduced significantly for the past five years to the benefit, mainly of road transportation. It has been assumed that this trend will continue mainly for commodities included in "others" category, which it is believed could be carried efficiently by truck. A 2% coefficient has been taken.

The same assumptions as for the pessimistic scenario were considered in terms of reduction of average distances.

These assumptions are considered when things remain the same. Construction of new lines are not considered. Their construction would affect significantly the volume in tons kilometres to the benefit of Uzbekistan Railways.

5.7 Tariffs

Tariffs for each type of commodity (including tariffs by ton-km) may vary significantly as shown in the following table.

TOTAL	13 913	17 539	70 986	0,79	196,00
Others (inc.cotton)	1 614	2 090	8 481	0,77	190,31
Gram	1 054	1 544	6 927	0.68	152.16
Fertilisers	514	1 076	3 350	0,48	153,43
Construction materials	1 208	4015	16 183	0,30	74,65
Timber	93	174	689	0,53	134,98
Black metals	187	414	1 487	0,45	125,76
Ores	179	392	1 263	0,46	141,73
Petroleum products	8 722	7311	28 727	1,19	303,62
Coke	11	16	75	0,69	146,67
Stone coal	331	507	3 804	0,65	87,01
San-					
COMMODITY	(in Min Sums) (i	n Min Tons-km) (i	•		
TYPE OF	REVENUES	TRAFFI	C	CANTE OF ILE	7-87***********************************

Therefore any serious change in petrol traffic will have a strong impact on the revenues and on the profitability of the railways. On both (conservative and optimistic) scenarios it has been considered that railway will loose traffic share on petroleum products. It impacts strongly on the revenues when production starts to reduce (2002), being the main cause for revenue reduction.

5.8 Traffic forecasts

5.8.1 Pessimistic scenario

5.8.1.1 Traffic forecasts by commodity

The traffic forecasts by commodity result from a combination between production growth and evolution of market share. The tables presented underneath show the expected traffic for each commodity in million tons-km and thousand tons.

Table n° 1: Forecasts by commodity (in million tons/km)

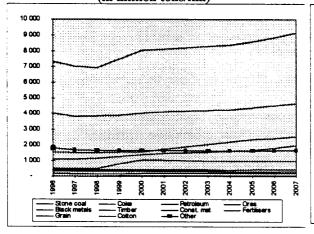
Commodity	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal	507	506	519	792	1 053	1 029	1 006	982	958	946	946	946
Coke	16	16	17	22	26	26	26	26	25	25	26	26
Petroleum	7 311	6 816	6 506	6 826	7 094	6 962	6 828	6 694	6 559	6 503	6 529	6 555
Ores	392	375	371	384	396	398	400	402	402	408	416	424
Black metals	414	409	416	418	419	416	413	409	405	406	416	427
Timber	174	166	167	170	174	179	181	183	185	189	195	201
Const. mat.	4 015	3 833	3 846	3 9 1 4	4 020	4 126	4 172	4 216	4 259	4 354	4 506	4 641
Fertilisers	1 076	1 098	1 149	1 274	1 392	1 453	1 510	1 562	1 611	1 676	1 820	1 964
Grain	1 544	1 506	1 512	1 536	1 558	1 729	1 890	2 042	2 184	2 346	2 440	2 533
Cotton	292	300	315	315	314	308	302	296	289	287	289	291
Other	1 798	1 682	1 654	1 650	1 660	1 670	1 655	1 639	1 623	1 625	1 649	1 664
Total	17 539	16 708	16 472	17 300	18 106	18 296	18 382	18 450	18 500	18 765	19 231	19 673

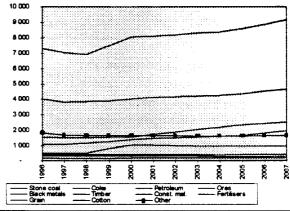
Table n° 2: Forecasts by commodity (in thousand tons)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006	2006	2007
Stone coal	507	491	488	723	932	884	838	793	751	719	698	677
Coke	16	16	16	20	23	22	22	21	20	19	19	19
Petroleum	7 311	6 816	6 506	6 826	7 094	6 962	6 828	6 694	6 559	6 503	6 529	6 555
Ores	392	364	349	350	351	342	333	324	315	310	307	303
Black metals	414	397	392	382	371	357	344	330	317	308	307	305
Timber	174	161	157	155	154	154	151	148	145	143	144	144
Const. mat.	4 015	3 718	3 619	3 572	3 559	3 543	3 475	3 407	3 338	3 310	3 323	3 320
Fertilisers	1 076	1 065	1 081	1 163	1 232	1 248	1 258	1 262	1 262	1 274	1 342	1 405
Grain	1 544	1 460	1 422	1 402	1 380	1 485	1 574	1 650	1 712	1 784	1 799	1 812
Cotton	292	291	297	287	278	264	251	239	227	218	213	208
Other	1 798	1 631	1 555	1 503	1 466	1 430	1 373	1 319	1 265	1 229	1 208	1 182
Total	17 539	16 410	15 881	16 383	16 839	16 690	16 447	16 187	15 911	15 818	15 888	15 930

Graphic n° 3: Future evolution of freight traffic (in million tons/km)

Graphic n° 4: Future evolution of freight traffic (in thousand tons)





5.8.1.2 Determination of the number of trains

Through the crossing of existing traffic by section provided by the railways and the breakdown by type of commodity issued on the Atkins report, it has been possible to evaluate the evolution of the number of trains on each section for each direction. The table 5.8.1.2 shows this evolution:

Section							raina						•
Change dy Listadia	3 255	1 867	199	1985	7 000	2 001 4 364	2 002 4 803	2 00% 7 780	2 004 4 456	7 200	7,000	7 007	200771986
	3 828	3 741	3 696	3910	4 131	4 130	4 096	3 948	4 026				
Little Control	1642	**************************************		**** *** **					4 U20	3 991 	3 960	3 918 ************************************	5%
000000000000000000000000000000000000000	1 642	1 611	1 591	1 689	1 788	1 786	1 774	1714	1 748	1 735	1 720	1 701	6%
Medical States	4.00		4 420	4730	5056	5 163	5232		3.350	5 400	5 (0 i		
Carried Contract	4 526 6 146	4 445 6 040	4 395	4 843	5 281	5 224	5 140	4 965	4 977	4 898	4 821	4 737	7%
	4 745	4 653	4 585	4 782	4 983	4 960	5 280	0.112	5061		4 678	4770	4%
Convert Services			**************************************		4 963	4 960	4 910	4 750	4 810	4 761	4 716	4 662	0%
	4 197	4 126	4 073	4 348	4 617	4 627	4 614	4 462	# 200 4 581	4 765 4 561	4 713 4 514	4 653 4 460	7% 8%
CONTRACTOR OF STREET	5286	**** **** ***	W 252	6 535	**************************************	35874	***** 5287 **	*****************************		**************************************		# #6U \$ ##\$\$	5% !!}
5000555555555555	5 219	5 100	5 000	5 229	5 458	5 402	5 321	5 143	5 163	5 085	4 999	4 905	-4%
Martinani Sahara		3.128	*********	3 285	3422	3.460		3 454	3.682	244	****	3506	12%
Amuzeng-Terrenz	2 341	2 291	2 256	2 329	2 407	2 422	2 422	2 342	2 418	2 414	2 392	2 365	3%
	**************************************	250	247	219 251	256		7.00	737	367	257	257	267	19%
Atterer-Nati Tulotta	******	*********			2364 2364	263 2.141	267 2 116	258 2:061	275	278	278	277	11%
	1 789	1 775	1 768	1 929	2 083	2 093	2 09 5	2 029	2.060 2.094	2 092	2 028 2 094	2.006	***
Building-Ferrip	1 181	* 112	1 105	****		1200	1211		**************************************	2 092	2 094 *******	2 093 #245	18% 19%
***************************************	1 204	1 181	1 165	1 186	1 210	1 251	1 282	1 238	1 337	1 361	1 357	1 351	14%
Sultan Karbi	1266	1 2006	1247	1 286	1 368	1 358	1 258	****	**************************************	1966	1945	***************************************	0%
Cazacian Urgeren	1 977	1914	1 881	1 906	1 943	1 949	1 932	1 857	1 901	1 885	1 867	1 844	-4%
	912	1 142 896	1 22	1 163	1202	1 208	1200	119	1.186	1 180	1176	1 158	2%
Knembed-Karasu	365	363	886 364	894 474	905	941	970	936	1 021	1 043	1 043	1 041	16%
************	3 6 5	358	355	369	579 383	367 391	554 396	535	628	616	663	491	25%
Kites-Kareh	316	863		855		331 ***********************************	390	384 8 5 8	405 848	408 890	408 888	406	13%
	840	827	822	870	920	932	937	908	945	948	948	886 946	4% 14%
Makend-Anders	442	446	444	477	500	619	925	900				540 540	2194
490000000000000000000000000000000000000	410	405	404	479	551	547	541	523	527	521	514	506	25%
Keward-Kenibadoes	3 68 6	3 623	3.001	2917	4 221	# 158	# 4.79	3946	3 330	3 867	2792	2724	2%
Komand-Karaeu	3 000 4 144	3 628 2 1 3	3 577	3 842	4 098	4 089	4 064	3 936	4 010	3 981	3 930	3 875	7%
***************************************	2 014	2 049	2 024	2 182	2 336 2 336	2 277	2300	2.285	2 322	7302	7270	2236	6%
Kungrad Banneu	482	467		2 102 	2 330	2 328 476	2 309 466	2 235 488	2 271	2 252	2 228	2 201	7%
	497	489	484	**************************************	495	517	535	516	566	441 579	#\$# 580	58 0	
Merakatat Karen	2372	2330	2 207	2408	2514	254\$		2 468	300	279 2560	2561	284¥	19% 9%
000000000000000000000000000000000000000	1 825	1 779	1 738	1 825	1911	1 877	1 836	1 772	1 757	1 719	1 679	1 638	-8%
Muruman Karl Kudu		210	200	214	219	210	217	210	214	212	210	207	- 2 %
Natus Kamanangal	219 ##6	213	210	215	221	221	219	212	216	214	212	210	-2%
***************************************	146	**************************************	142	142	168 142	161	162	157	784	3885	167	169	17%
Sales (Chargican)					142 214	152 213	160	154	174	181	181	181	26%
	511	511	516	540	565	578	*12 587	588 567	70 6 601	7 40 5	7 0 0 624	693	24
SWI-AWA-THROUGH	1 068	1026	1013	4.057	**************************************	*****		**************************************	1070	1.000	024 ************************************	638 1 049	25%
44/4/24/24/24/24/24/24/24/24/24/24/24/24	1 022	1 003	990	1 030	1 070	1 089	1 101	1 065	1 121	1 129	1 124	1 116	11%
Teknestosk-Kangrad		845	867	***	914	807	286	258	865	851		825	
Telemanijan Karon	876 1 606	861	852	859	868	906	938	905	992	1 016	1 017	1 015	18%
······································	1 606	1 577	1 561	1 620	1 68 2	**************************************		1512	***	****	1512	1 468	+4%
Termer M 161	**************************************			1620	1 682	1 709 5 179	1 725	1 669	1 751	1 761	1 757	1 749	11%
	1 350	1 322	1 305	1 366	1 429	333 33333 3333333333333333333333333333	1 417	1 370	1 396	1 205	1110	1092	***
Contractor Attenta		44			822			1370	1 396	1 385	1 375	1 362 368	3%
	621	605	595	609	626	62 7	6 2 2	600	613	608	602	59 5	-2%
Dyundi-St 449				***		3.010	1 406	#6 4			978		12.
	876	860	852	861	873	907	934	901	980	1 000	1 001	999	16%

The last two columns show the increase in percentage and the maximum number of train over the considered period of time for each section. This increase is relatively high on some sections:

- Khanabad-Karasu (82%)
- Kokand-Andijan (54%) and return (66%)
- Angren-Kizil Tukmachi (74%) and return (54%)
- Mekhnat-Khabast (54%)
- Chengeldy-Uzbekistan (51%).



The maximum number of daily train is of main interest in terms of capacity. In this scenario no major constraint is faced considering:

- Djizak-Khavast section (89 km) will see its traffic reduced by 7% by the year 2007 compared to the year 1996.
- The sections Meknat-Khavast and Djizak-Marakand, even if they are double track, will have to cope with a fairly high traffic: between 16 and 18 freight trains per day and direction. Nevertheless the capacity of the line allows fully to cope with such traffic.

Passenger trains should be added to these figures.

5.8.1.3 Revenues

Revenues are calculated on the basis of tons-km tariffs and forecasts.

TYPEOF		***************************************	*****				KIII tai		Torecas	its.		
COMMENTS						有数准数据 推						
Name of the second	7.7	1947	7865	1000	2000	2001	2002	2003	2004	\$400	2006	
L.							***********	********	********			
Stone coat	331	\$2A	**************************************		500	55555555 556666 55555	000000000000000000000000000000000000000		000000000000000000000000000000000000000	************	******	
Coke	11	**************************************	**************************************	***********		000000 000 000000000000000000000000000	**************************************	~~~~ ?\$\$ \$	490	#70	456	442
Petroleum empuns	************		1 1 00000000000000000000000000000000000	14	16	15	15	14	14	13	13	13
Отев	******		7.767	B 144	8 463	8 303	# 346	7985	7.824	7.758	7.789	7.820
Markagana and a construction of the constructi	179	166	159	160	160	156	152	148	144	142	140	139
Black rectals	187	179	177	172	168	161	335	149		******	******	
Timber	93	86	84	83	82	82	**************************************	******	*******	139	139	136
Construction materials	********	**************************************	* 189	2222 222222				79	77	77	77	. 77
Fertilisers	514	509	accordances (COO)	SSS AND	1471	1966	1 046	1 925	1 004	996	1 000	999
Crean			517	555	589	596	601	603	603	609	641	671
	1.054	997	971	957	942	1014	2075	1126	**************************************	************	**************************************	1297
Others (inc.cotton)	1 614	1 484	1 430	1 382	1 347	1 308	1 255	1 203	1 152	1 117	1 098	escocococono secoco
TOTAL	13 913	13 003	12 517	13 014	13 445	13 281	13 072	12 851				1 074
			~~~~~		~		13 0/2	12 891	12 621	12 538	12 580	12 608

#### 5.8.2 Optimistic scenario

#### 5.8.2.1 Traffic forecasts by commodity

The traffic forecasts by commodity result from a combination between production growth and evolution of market share. The tables presented underneath show the expected traffic for each commodity in ton-km and ton.

Table no 1: Forecasts by commodity (in million tons/km)

Commodity	1996	1997	1998	1999	2000	2001	£3005	**************************************	······	<del></del>	***********	
Stone coal	507	506	*****	£	***************************************	***************************************	2002	2003	2004	2005	2006	2007
Coke	*************	•	519	792	1 053	1 029	1 006	982	958	946	946	946
	16	16	17	22	26	26	26	26	25	25	26	26
Petroleum	7 311	7 027	6 915	7 480	8 013	8 107	8 198	8 285	8 368	***************************************	<del></del>	***************************************
Ores	392	375	371	384	396		<del></del>	<del></del>	·	8 554	8 854	9 164
Black metals	414	409	416	·	<del></del>	398	400	402	402	408	416	424
Timber			<b>5</b>	418	419	416	413	} 409	405	406	416	427
***************************************	174	166	167	170	} 174	179	181	183	185	189	195	201
Const. mat.	4 015	3 833	3 846	3 914	4 020	4 126	4 172	4 216	4 259			
Fertilisers	1 076	1 098	1 149	1 274	1 392	1 453		·> · · · · · · · · · · · · · · · · · ·	<b>*</b>	4 354	4 506	4 641
Grain	1 544	1 506	1 512			•	1 510	1 562	1 611	1 676	1 820	1964
Cotton	*************			1 536	1 558	1 729	1 890	2 042	2 184	2 346	2 440	2 533
	292	300	315	315	314	308	302	296	289	287	289	291
Other	1 798	1 682	1 654	1 650	1 660	1 670	1 655	1 639	1 623	d		
Total	17 539	16 919	16 881	17 953	19 025	19 441	19 751	*****		1 625	1 649	1 664
				555	3 10 020	10 441	19/51	20 041	20 309	20 816	21 556	22 281

Table n° 2: Forecasts by commodity (in thousand tons)

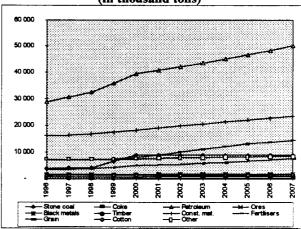
Commodity	1996	1997	1998	1990	2000	2001	2002	2003	2004	2005	2006	2007
Stone coal	3804	3994	4 184	6530	8876	8876	8876	8876	8876	8876	8876	8876
Coke	75	79	84	111	139	141	142	144	146	148	151	153
Petroleum	28727	30595	32 462	35 884	39306	40682	42 106	43580	45105	46 684	48318	50009
Cres	1 263	1 273	1 284	1359	1 434	1476	1 517	1559	1600	1642	1675	1708
Black metals	1 487	1548	1609	1650	1692	1717	1743	1769	1795	1 821	1868	1 916
Timber	689	692	710	738	775	814	842	872	902	934	967	996
Const. mat.	16 183	16 264	16 671	17 337	18 204	19 114	19783	20476	21 192	21 934	22702	23 383
Fertilisers	3350	3599	3847	4358	4869	5 199	5530	5861	6 191	6522	7083	7643
Grain	6927	7110	7293	7 574	7856	8916	9976	11 037	12097	13 157	13 681	14205
Catton	1 187	1 283	1 378	1 406	1 433	1 438	1 443	1 448	1453	1 458	1469	1 480
Other	7294	7184	7216	7355	7568	7787	7899	8012	8126	8243	8360	8439
Total	70 986	73 620	76 737	84 303	92 162	96 161	99 869	103 632	107 485	111418	115 149	118 907

Graphic n° 3: Future evolution of freight traffic (in million tons/km)

(In million tons/km)

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Graphic n° 4: Future evolution of freight traffic (in thousand tons)



These graphics shows a strong increase in oil products for the year 2000 and then a progressive reduction to come back to 1997 figures. It is due to two phenomenons:

- the reduction of oil production from 2000
- the reduction of the traffic share.

However, his drop is compensated by increases in construction materials, grain and fertilisers traffic.

#### 5.8.2.2 Determination of the number of trains

Through the crossing of existing traffic by section provided by the railways and the breakdown by type of commodity issued on the Atkins report, it has been possible to evaluate the evolution of the number of trains on each section for each direction. The table 5.8.2.2 shows this evolution:

	930 1 221 1 726 1 283	3 828 3 828 1 642	3 <b>976</b> 3 870 3 870	# 586 3 958	100		2001				<u></u>			•	MAX
Albanian (1774) Marina Kalesa Dana Kalesa	930 1 221 1 726 1 283	3 828	3 870				doport vitter N		200	100	<b>****</b>	<b>****</b>			TRAN
	1 221 1 700 1 283				4 304	4 675	4 787	4 864	4 944			3.00			30
December 1999	1 283	1 642		**************************************	1 104	202	200			5 025	5 109	5 211	5 302	3 <b>7%</b>	18
December 1999	1 283	No. 100 (1990)	1 673	1 719	1 868	2 025	2 055	2 074	2 093	2 114	2 136	2 168	2 196	31%	7
		4 526	4 622	4.678 4.758	5 368	5 997	5876	0.004		# <b>#</b>	0.000	##	2021		<b></b>
	194	4 144	333	6 400	35.000	9.25A	6 036 6 225	6 045 <b>5 266</b>	6 058	6 074 <b>5 706</b>	6 094	6 148	6 191	34%	21
	1 710	4 745	4 864	5 017	5 342	5 881	5 693	5 678	5 669	5 <b>664</b>	5 <b>66</b> 5	5 726	5 <b>454</b> 5 778	19%	
Ki <del>ne an Heuto</del> s	1 544 2 169	4 416	4 523	***	\$ 073	S 467	5 520	5.554	5540			3720 <b>5621</b>	3//6	1976	19
Corporation of the Corporation o	∠ 109 4028⊗	4 197 <b>5 365</b>	4 293 ###88	4 414 **********************************	4 809	5 213	5 <b>2</b> 71	5 307	5 343	5 381	5 421	5 470	5 511	28%	18
	1 648	5 219	5 347	5 <b>50</b> 5	<b>64066</b> 5866	6 235	<b>6 747</b> 6 179	444	7 026	7 170	7 315	7528	7 676	40%	26
Marakand-Suknasa	1996	****	3.250	3340	3 <b>304</b>		2 94S	6 099 4 092	6 024	5 <b>95</b> 5	5 892	5 <b>885</b>	5 870	10%	21
X <b>455555</b> 555555	1 908	2 341	2 384	2 445	2 577	2717	2756	2 779	2 802	2 827	2 853	2 881	4 <b>674</b> 2 904	***	**************************************
Amuse lame:	<b>79</b> 7	<b></b>			****			200				2 00 1	2 904 346:::	22% ***********************************	10
Argum Kimi Tulong	/8/ 3/884	256 ***********	257	262 *********	272	284	298	309	320	331	342	350	357	39%	••••••••••••••••••••••••••••••••••••••
	1 163	1 789	1 834	1 888	2 117	2 349	2 418	2490		200	2607	2765	2700	745	
Skarnera Former	1072	****		3 3 3 3 5 5			2410 ************	2 480	2 543	2 605	2668	2 746	2 821	54%	9
	2 515	1 204	1 213	1 231	1 280	1 333	1 398	1 454	1 508	1 560	1 612	1 638	1 636 1 661	42% 37%	<b></b>
	1 479					188	1.540	9.660	1575					3/78 220%	6 
	14/9 * <b>306</b> ***	1 977 \$ <b>16</b> 6	1 983 1 166	2 019	2 103	2 202	2 256	2 287	2 320	2 354	2 390	2 432	2 466	24%	8
	1 255	912	917	**************************************	958	991	**************************************	+ 412		1 452	1 423	1 527	1 537	335	<b>******</b> ******************************
Comments Format	210	300					1 051	1 103	1 154	1 203	1 250	1 276	1 298	42%	4
89800000000000000000000000000000000000	299	<b>36</b> 5	370	379	402	428	444	458	471	677 484	<b>476</b> 498	508	517	62%	*
Kilab-Karah	3.003		<b>481</b>	802	939	925	1025	1063	¥ 082				317 31234	40% 37%	2
Kokand-Andras	740 713	840 <b>842</b>	854 <b>450</b>	878	954	1 035	1 071	1 100	1 129	1 158	1 188	1 220	1 249	46%	4
	1 180	410	418	430	528 524	<b></b>	500	600	820	840	400	877	663	54%	
Kolend-Kanibedom	1010	2723	****	3772		621 4 626	634	644 <b>4.700</b> 0	653	663	673	683	692	66%	2
	2 393	3 686	3 788	3 906	4 273	4 643	4 653	4 648	4 645	4.673 4.644	4 516 4 646	4.665	4.010	188	<b>15</b>
	1962	2 122	2 181	236	2.430	2.673	2672		2657	200	266	4 0000 2 0052	4 679 2 669	24%	16 <b>9</b>
Kingrad Banas	1 266 688	2 014	2 068	2 134	2 348	2 565	2 577	2 579	2 583	2 588	2 595	2 619	2 640	28%	‱
	**************************************	497	500	<b>507</b>	523	<b>546</b>		6.6	542	440		540	<b>S41</b>	115	
Marakand-Karcis	333	<b>24 972</b>	****	2 470	2045	541	575 <b>2005</b>	606	635	<del>663</del>	691	705	718	44%	2
	2 090	1 825	1 870	1 925	2058	2 192	2 150	2 101	2 054	2 009	31466 1966	3 246 1 948	3 200		*1 7
	234	210	221	223	236	245	254	209			275	279	1 927 284	3%	
Notes Kurretungus	1 265 952	219 <b>146</b>	221 1 <b>50</b>	227	238	250	255	258	260	263	266	270	274	24%	**************************************
	116	146	146	147	149	170	126	*****	199	235	212	221	290	54%	
Sation Attractionary	<b>854</b>				757	152 <b>804</b>	165	176 <b>3844</b>	187	198 **********	208	212	215	47%	1
	485	511	527	548	591	638	673	704	735	<b>879</b> 766	798	945 845		334	
an Anyo Terren	700	1050	108	1.076	1135	1 235	120	* <b>242</b>			30 <b>30 3</b>		891 1 428	69% 369%	3 #
Skindad Karaji	306 906	1 022	1 035	1 055	1 123	1 194	1 235	1 270	1 304	1 337	1 370	1 394	1 414	37%	5
	142	876	881	<b>943</b> 891	918	947	1.003	106	1 043	1042	1042	1001	1657	15%	
	042	100	******	**************************************	**************************************	**************************************	1 007	1 060 *********	1 111	1 160	1 208	1 231	1 252	42%	4
	737	1 606	1 631	1 669	1 774	1 885	1 946	1996	2 046	2 096	1 <b>145</b> 1 2 145	2 189	2 223	27W	
ermea EX 161	811	\$ 100	1100	1 180	126	1 320	1 256	+ <b>378</b>			2 145 3 445	2109	2 228 1 <b>895</b>	37%	7 **** <b>9</b> ***
	441 219	1 350	1 374	1 409	1 513	1 622	1 648	1 <b>66</b> 6	1 685	1 704	1 725	1 756	1 784	30%	88888 <b>7</b> 888
	288	621	626 628	<b>64</b> 2	674	70E		750	760	78.6	770	793	606	200	•
	<b>345</b>		**************************************	31.2225	0/4 33 <b>333</b> 3	710	723	730	738 ************************************	746	755	7 <b>6</b> 6	776	24%	3
	<b>4</b> 91	876	881	894	924	959	1 016	1 <b>08</b> 5	**************************************	1 160	1 206	1 232	1 255	27% 42%	4

The last two columns show the increase in percentage and the maximum number of train over the considered period of time for each section. This increase is relatively high on some sections:

- Khanabad-Karasu (82%)
- Kokand-Andijan (54%) and return (66%)
- Angren-Kizil Tukmachi (74%) and return (54%)
- Mekhnat-Khabast (54%)
- Chengeldy-Uzbekistan (51%).

The maximum number of daily train is of main interest in terms of capacity. The main problems will lie in these sections were capacity won't allow for the planned increase:

- Djizak-Khavast section (89 km) will obviously be a main difficulty, being single track. It will have to cope with about 20 freight trains on each direction. This constraint will affect strongly the operation and deteriorate the already high travel time (around 3 hours and 30 minutes for an average speed lower than 30km/h).
- The sections Meknat-Khavast and Djizak-Marakand, even if they are double track, will have to cope with a fairly high traffic: around 25 freight trains.

Passenger trains are not accounted for here and should be taken into account for the purpose of measuring the need for capacity.

#### **5.8.2.3 Revenues**

IOIAL	13 913	13 406	13 305	14 262	15 191	15 470	15 698	15 911	16 110	16 499	17 067	17 636
TOTAL	42.040	40 400	40 005	44.000	45.40.4							
thers (sac cettes)	1 6 1 4	1 531	1 5 2 1	1 5 1 7	1 524	1 5 2 7	1511	1 494	* <b>* * 7</b> 7	1 803	1 494	1328
1944			******				7 2 1	746	769	801	869	• 3 8
ertilis ers	514	525	549	•	465	***	1.00	***	****	1110	1334	1394
	93 333333 <u>1331314</u> 3333	8 9 ::::::::::::::::::::::::::::::::::::	8 9 	91	93	96	9 7	9 8	9 9	101	1 0 4	108
Pagenta de la telega. Fina ber		***	***	144	<b>##</b> #		194	***	***	***	***	
0 re s	179	171	1 6 9	1 7 5	181	1 8 2	1 8 3	1 8 3	184	1 & 6	; 9 C	194
*******	# * <b>*</b> * *	4 ***	****	****	***	******	******	 	 	1.7 000000000000000000000000000000000000	18 3333 <b>666</b> 3866666	1 8 33333 <b>686386868</b> 3333
C e k e	1 1	11	11	1 5	1.8	1.6	1	1.8	<b>4¥</b> 17	***	***	***
*******			::::::::::::::::::::::::::::::::::::::		Nananan kananan kanan	000000000000000000000000000000000000000	*************					
or Morris	138	657	1999	9000	2000	200	3322	223	2004	2005	2005	2007
I THE CF						REEL	50 (A) (A) (A)					

#### 5.8.3 Impact of a pipeline construction

The hypothesis for the construction of a pipeline are the following: 2000: implementation of the east - west pipeline linking Ferghana valley and Bukhara area.

The corresponding traffic and revenues for the railways would be the following:

#### Pessimistic scenario

TRAFFIC (T)	1996	1997	1998	1999	2000	2001	2002	2003	***************************************	·····	<del>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</del>	
Stone coal	3 804	3 874	3 937	5 960	******	******	·	***************************************	2004	2005	2006	2007
Coke	75	77	79	*	7.858	7.622	7 393	7 172	6957	6 748	6 545	6 349
Petroleum	28 727	÷	<b>5</b>	102	123	121	119	117	115	113	111	109
_	<del></del>	29 677	30 544	32 751	34798	29 935	25 073	25 073	25 073	25 073	25 073	25 073
Ores	1 263	1.235	1.208	1 240	1 269	1 267	1 264	1 259	1 254	1 248	1 235	1.222
Black metals	1.487	1.501	<u>1 513</u>	1 506	1 498	1 475	1 452	1 429	1 407	1 384	1 378	1 370
Timber	689	672	668	674	686	699	702	704	707	710	713	712
Const. mat.	16 183	15 776	15 685	15 823	16 116	16 414	16 479	16 544	16 609	16 675	16 741	
Fertilisers	3 350	3 491	3 620	3 978	4310	4 465	4606	4735	4852	***************************************		16 726
Grain	6 927	6 897	6 862	6 913	6955	7 657	8310			4 958	5 223	5. <b>4</b> 67
Cotton	1 187	1 244	1 297	1 283	1 269	***************************************		8 9 1 8	9 481	10 003	10 089	10 161
Other	7 294	6 964	6 781	6700	***************************************	1.235	1 202	1 170	1 139	1 108	1 083	1 059
Total	-			***************************************	6 683	6 666	6 5 5 5	6 445	6 337	6 231	6 126	5 995
· Can	{ <b>70 98</b> 6 }	71 407	72 193	76 928	81 564	77 556	73 155	73 566	73 931	74 251	74 317	74 243

TRAFFIC (TK)	1996	1997	1998	1999	2000	2001	2002	2003	***************************************	······	,	,
Stone coal	507	491	488	723	*	-	-	-	2004	2005	2006	2007
Coke	16	16	16	<del>}</del>	932	884	838	793	751	719	698	677
Petroleum	7311	6816	<b>*</b>	20	23	22	<u>22</u>	21	20	19	19	19
Ores	392	·····	6 506	6 826	7 094	5 965	4 882	4767	4 652	4594	4 594	4 594
Black metals	~~~~~	364	349	350	351	342	333	324	315	310	307	303
*************************	414	397	392	382	371	357	344	330	317	308	307	305
Timber	174	161	157	155	154	154	151	148	145	143	144	144
Const. mat.	4.015	3718	3 619	3 572	3 559	3 543	3 475	3 407	3 338	3 310	3 323	3 320
Fertilisers	1 076	1 065	1 081	1 163	1 232	1 248	1 258	1 262	1 262	1 274	1 342	***************
Grain	1544	1 460	1 422	1 402	1 380	1 485	1 574	1 650	******************************	••••••		1 405
Cotton	292	291	297	287	278	264	251	***************************************	1 712	1 784	1 799	1.812
Other	1 798	1631	1 555	1 503	1 466	**********	************	239	227	218	213	208
Total	17 539	16 410	15 881	······		1.430	1 373	1 319	1 265	1 229	1 208	1 182
	,	10410	12001	16 383	16 839	15 694	14 500	14 259	14 004	13 909	13 954	13 060

REVENUES IN MISUM	1996	1997	1998	1999	2000	2001	2002	2003	2004			-
Stone coal	331	320	319	472	609			-	2004	2005	2006	2007
Coke	11	11	11	<del>}</del>	<del>}</del>	577	547	518	490	470	456	442
Petroleum	8 722	8 132	<del></del>	14	16	15	15	14	14	13	13	13
Ores	179	166	7.762	8 144	8.463	7.117	5.824	5.687	5 550	5.481	5 481	5 481
			159	160	160	156	152	148	144	142	140	139
Black metals	187	179	177	172	168	161	155	149	143	139	139	138
Timber	93	86	84	83	82	82	80	79	77	77	77	77
Constr. mat	1 208	1 119	1 089	1 075	1 071	1 066	1 046	1 025	1004	996	1 000	999
Fertilisers §	514	509	517	555	589	596	601	603	603	609		
Grain [	1054	997	971	957	942	1 014	1 075	1 126	***************************************	***************************************	641	671
Others (inc.cotton)	1 614	1 607	1 640	1 587	1 535	1 461	1 389		1 169	1 218	1 228	1 237
Total	13 913	13 126	12 728	13 219	13 634	·	~~~~~~~~~	1 320	1 254	1 205	1 178	1 152
			12.720	10218	13 634	12 245	10 883	10 669	10 448	10 349	10 353	10 348

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TRAFFIC.(T)	1996	1997	1996	1999	2000	2001	2002	2003	2004	2005	2006	2007
Screozi	3804	3994	4184	···6 <b>5</b> 30··	8876	8876	om	OCTY	0077	000	007	Ě
	3031	2 <del>224</del>					····8876···	····8876···	····8876···	8876	8876	8876
6de	-	<i>1</i> )	84		139	141	142	144	146	148	<del></del>	153
Retroleu	2277	20405	2042	_⊃C00/	2020	2000	2010	2010	ကကို	ဘက်	ကက်	
	25/2	170	22-12	2000	25200	2000	22100	32100	22100		32100	32106
72	123	123	1284-	<del>135</del> 9	<del>1484</del>	1476	1517	<del>-159</del> -	<del>1600</del>	162	<del>-1675</del> -	1708
Backmetals	1.427	1548	1200	1/20	1400	1777		170	1705		100	
T. I.	145/		100	IW	102	1717	1748	1707	1720	1821	100	1916
Enter			·····710··	738	·····77	814	842	872	902	984	967	926
Cost nat	16 102	ICYA	1667	177777	1074	10114	10730		71.100	21024		
Continue	3360	2500	100/1	17307	10204	17114	יסו כו	20476	2112	222		23383
G1835	330	35))	3847	<del>438</del> -	489	<del>519)</del> -	5530	586	<del>619</del> 1	-6522	702	<del>764</del> 3
Grai	6927	71 <b>10</b>	- 7298 -								700	
				····7574···	7866	<del>891</del> 6	9976	···1 <del>1037</del> ··	12097	13-157	1368t	14205
Games	1187	<del>1283-</del> -	<del>1378</del>	-1406-	1433	-1488-	<del>148</del> -	142-	142	1.450	1.40	1480
3 <b>9</b>	7701	7104	7216		750	7727	7900	6UD	917	140	920	1-60
Total	7		7220	735					·····•	8243	····· <del>O</del> 330/···	8499
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#### 6. Financial analysis and Control

The Uzbekistan Railway (UTY) authorities have supplied some financial, accounting, operating and commercial statistics or data to the consultants to assist in the assessment of the financial state and prospective profitability of the railway and its constituent businesses.

Unfortunately, verifiable sources of UTY operating statistics, and details of staff numbers and associated expenditure by department, were not made available to the consultants. Therefore the following allocations are on the basis of 'Best Estimates' with the information which it has been possible to assemble from various sources. However it has not been possible to verify or cross check the figures used.

Use has been made of other recent consultant's reports on UTY, notably the TACIS TRACECA rolling stock report; and the 'Padeco' report. Certain assumptions in these reports may be amended as a result of the consultant's findings in other Central Asia Railways and recent experience in former CIS railways.

It would appear that Uzbekistan Railways (UTY) have adopted a non standard form of presentation of the 'working expenses' in that the staff costs quoted for the Wagon Department do not correspond with the sum of the staff costs as reported to the consultant. It appears that the 'Staff cost' figure for the Wagon Department in the 'working expenses' represents only the 'direct labour' element of the staff costs. Such inconsistencies can only lead to confusion and misinterpretation.

An analysis of the Uzbekistan Railways operating expenditure for the 1st half of year 1997 is at Annexe 1.

The section below is the consultant's recommendations for the future financial control and business evaluation of UTY, both in its present structure, but leading to a business orientated management structure which is proposed elsewhere in the study.

#### 6.1 An Outline Approach to Railway Business Evaluation

Financial analysis and control concerns the overall financial evaluation of the profitability of the business. This may be further analysed into identifiable constituent parts. At its highest level this is the 'Profit and Loss Account' for the business as a whole. The next level of business evaluation is the identification of those parts of the business for which meaningful costs and associated income can be determined. For example, profitability statements can be prepared separately for the Freight business and the Passenger business, and also for sub-divisions of these main businesses. These identifiable parts of the business can be called 'Profit Centres'.



In addition, overall and localised cost control and productivity monitoring down to Cost Centre level, is accomplished through the budgeting process in which predetermined levels of activity and associated expenditure and income (where appropriate) are measured against actual performance.

### 6.2 Budgetary control and Cost centres

The Budget Process is a means of setting out the plans of an organisation. The process for the railway should start by agreeing the amount (volume) of traffic, both freight and passenger, that will be carried in the future period and the revenue to be earned; and also identifying the resources necessary to achieve that business plan.

The revenue income for the railway is earned by selling services—to freight customers, and by carrying passengers. Such income will only materialise if the railway provides the service that the customer requires and at a price that seems reasonable. The planning of service provision starts with market research to know what the customer wants by way of a transport service, and how the railway can satisfy these needs by running trains commensurate with the assessed demand. A budget of expected income is prepared for each Profit Centre - that is, each identifiable portion of the overall business for which a reasonable assessment can be made of the revenue income, and the associated costs of production.

The expenditure budget is the financial measure of the use of resources and facilities necessary to achieve the production of the transport service. The various functions within the railway organisation (selling/marketing, operations, maintenance and infrastructure, etc.,) will each have an input into the overall production plan. The cost of that input will be reflected in their individual budgets.

Financial and management control may exercised through the setting of targets or budgets. To be effective the output should be managed in small packages—that is in defined parts of the production area which are the responsibility of one manager or supervisor. This area of responsibility is called a Cost Centre. A single manager may be responsible for several Cost Centres.

In assessing the costs associated with a Profit Centre, some costs centres will provide work or services to only one profit centre whereas most cost centres will provide service to several Profit Centres and some means will be required to apportion the costs between them. The method apportionment will vary according to the type of work or service performed and the ability to measure the output to provide a fair method of sharing these joint costs. The method may be based on share of the total hours of use or distance travelled, or quantity of stores consumed e.g. fuel for locomotives can be assessed as 'litres per gross tonne kilometre' x cost per litre issued; the time cost for using rolling stock would be calculated in terms of 'cost per hour in service'.

#### 6.3 Business units

Business units can be defined as those elements of activity, within the overall Railway organisation, where the income and expenditure associated with production of the service/ activity are identifiable, thus enabling a view to be taken of the 'profitability' of that activity.

The main activity of a Railway is the production of Passenger and Freight train services. There may, in addition, be several other activities undertaken by the Railway, which it is appropriate to regard as businesses. Examples of these additional business units include the 'Industry Units' and the "Management of the Railway Infrastructure",

The State may assume ownership and responsibility for the railway infrastructure, but the day to day management of the Railway Infrastructure may be delegated to the Railway, for the duration of an 'Operating Contract' between the State and the Railway.

The Business Units must be meaningful and practical, and be able to determine both receipts and costs, if they are to be used as a basis for business evaluation and decision making. The use of resources and their associated costs must be sufficiently particular to the specific services of the Business Unit to make their identification and method of allocation to that business appear to be sensible. That is, after time for adjustment and understanding the methodology, these costs could be 'avoided' by the railway in the absence of that specific Business Unit. Receipts also must be reasonably attributable to the services provided, although some 'joint revenue' (between competing and connecting business units) may be inevitable.

The proposal for creation of Business Unit reporting can be accomplished using present manual accounting systems, but would also work more efficiently if the railway adopted a computerised Financial Accounting and Management Reporting system (MIS).

Making progress towards the efficient management of these Business Units may suggest certain organisational changes that will provide for executive responsibility for managing and controlling the income and expenditure attributable to each Business Unit. As an initial stage, it is suggested that the railway identify Business Units for Passenger; Freight; Infrastructure; and possibly also for certain 'Industrial Units'

- Passenger Business may be subdivided into the following service groups: Long distance Express; Suburban; Regional; Special Services
- Freight Business may be subdivided to Trainload Services (where 'block train working' is adopted for certain commodities - such as coal, oil, or ores;) Wagonload Services; Less than Wagonload
- Parcels (including postal services)
- Infrastructure

Industrial Units may be designated as separate Business Units



The creation of the Business Units listed above, and any future sub-division of these units, implies that the Revenue Income and the Expenditure/ Costs of Production can be meaningfully identified and attributed, as described above, to the individual business units,

After some working experience of the system inputs and the output results, there will be a desire to refine the Business Units structure to take account of the changing needs of the Railway management. This can readily be achieved by following through the original requirements for identifying the specific income and expenditure of each of the new Business Units.

### 6.4 Traffic costing or business evaluation

The main aim of Traffic Costing or Business Evaluation is to assist management to understand the commercial viability of the various 'transport products' (Block train freight services, wagon load freight, express passenger or local passenger trains) that are provided by the railway company. The process of Traffic Costing is not the same as an annual 'profit and loss account', but is an assessment of the economic value to the business, and therefore uses a 'longer term' (or smoothed average) view of costs.

Traffic Costing may be used to provide an advisory service to the Marketing Departments as an aid to understand tariff setting and profitability; and also by the financial planning department for use in determining longer term strategy and investment decision making.

Where the Financial Accounts process the current income and expenditure, traffic costing uses accounting information over longer periods, and analysed by type or function of the expenditure together with the associated measures of output or production within each activity for the same financial period.

Traffic costing may approach cost analysis from either the total business expenditure (based on the annual expenditure statement and operating statistics) or by detailed analysis of the costs at specific locations or cost centres.

The first approach- the 'top down' method- uses the annual statement of expenditure, but with reconcilable differences (for example annual depreciation charges will be adjusted to reflect the cost of replacement by modern assets at present day prices, and the maintenance of rolling stock will represent the average annual cost taking account of life cycle costs of periodic major overhauls). This type of cost analysis will provide a general view, using broad average costs over large sections of the business.

The alternative approach examines the costs of specific parts of then system is using local data of costs and production. A sum of the relevant items of this local costing data may be used to assess the economics of individual flows of traffic. However this methodology and 'specific' costs must be used with caution, since experience shows that the sum of all the expenditures apportioned to individual flows rarely equates to the total system expenditure.



#### 6.5 The application of traffic costing

The application of Traffic Costing requires an understanding of railway operations. The analyst needs to identify the various processes that are involved in the provision of train services in order to prepare a meaningful analysis of the available financial and statistical data. The costs of some of these processes will vary proportionally with the volume of service or traffic activity on the railway, whereas other cost will only change as performance requirements trigger the provision of additional resources (e.g. a 'step change') There are other costs which do not appear to vary with the volume of activity e.g. the provision of basic track and signalling facilities.

#### 6.6 Calculation of unit costs

The calculation of unit costs appropriate to the activity, involves the identification of the activity and the application of the related production statistics. For example, fuel for train working may be expressed as a cost per gross-tonne-kilometre; train crew or locomotive drivers can be measured as a cost per productive driving hour-derived from the cost of salaries and other directly associated payroll costs for loco drivers at the depot which provides the train service, divided by the number of productive train hours worked by that depot, over the same financial period.

#### An APPROACH to MEASURING COST and PROFITABILITY of Railway Traffic

The value of railway traffic may be assessed by measuring the current income against the identifiable direct expenditure incurred in carrying the traffic, and viewing the (positive) balance as a contribution to the indirect joint and common costs of all other expenditure, such as Administration and the cost of providing and maintaining the Infrastructure.

From information available at the depots it is possible to analyse the staff costs in the Locomotive department to Drivers, by type of traction. Thus it is possible to establish an approximate cost for drivers costs for passenger and freight working.

There appears to be an adequate source of expenditure analysis at locomotive department depot level of Uzbekistan Railways to provide a form of 'Depot Costing System' which can identify cost of maintenance by type of traction, or at least by 'workshop' within the repair works.

Fuel for traction may be allocated between passenger and freight on the basis of the gross-tonne-kilometres produced.

Part of the Infrastructure costs may be debited to passenger on the basis that a portion of track maintenance costs are incurred because of the higher standard of track required to run a passenger service. Similarly the standard of provision and maintenance of signalling equipment is higher passenger routes.

Using some reasoned approximations, a first attempt has been made to show the profitability or otherwise of the passenger and freight business of UTY last year (1996).

#### See Annexe 1

This indicates that the freight business appears to be profitable, in that it covers its working expense (excluding capital costs for locomotives and wagons) and also the cost of maintaining the track and signalling systems. The passenger business fails to cover the "out of pocket" expense of running the trains, by a considerable margin,; and indeed makes serious losses

A more detailed approach to cost analysis on UTY will give a clearer picture of how the costs should be apportioned. This will then enable reasoned management action to be taken to improve the financial performance.

### PROPOSED COST and PROFITABILITY ANALYSIS SYSTEM

In proposing a costing system for any business, it must be recognised that the prime purpose of the system should be to provide meaningful information on a regular basis to managers at the lowest possible level, so that they can fully appreciate the costs and "profitability "of their part of the organisation, measured against an agreed budget or "transfer price" within the business sector. The objective must surely be to assist in the promotion of a business that provides "value for money spent".

A suitable Cost and Revenue Analysis System will require to reflect the various "business activities" of the railway. In any railway the basic unit of production is a train. The costing and revenue analysis system is therefore attempting to identify the costs and revenue associated with the running of a train service. A sample of the type of report which may be produced for each 'Business' or for each 'Profit Centre', using a Cost and Profit Centre Analysis system is at the end of this section.

The first main division is to identify the Core Business-that is to account for Passenger, Freight, and Other Activities in such a manner that the cost of providing the service can be matched with the revenue generated by that part of the business activity. It may then be possible to further sub-divide each activity into sectors to which revenue and costs can be specifically identified.

#### Revenue allocation:

In the Passenger Business, it may be possible to account separately for each or some of the following sectors: International Services, Inter-regional Services, Main-line, Suburban, and Branch line Services. Within each of these 5 sectors it may then be possible to achieve a further analysis into several "Profit-Centres" which group together to make up the Sector.

The revenue which is attributable to each profit centre is identified by surveying the number of passengers using each specific service, and allocating the revenue according to the type of ticket held, i.e. taking account of the use of discounted tickets on the service to calculate an average earnings per passenger-kilometre for each profit centre.



The survey of use of each service may be undertaken using statistical sampling techniques once the initial groundwork has been completed. Sample surveys may be carried out at varied intervals to confirm the allocation of earnings between services that provide a joint service along a part of the route. This is specially necessary where there have been major changes in the service or where changes in the number of passengers is noted from the accounting returns or other control data. The allocation of revenue to profit Centres, Sector and Business can be linked into the Financial Accounting and Budgetary Control systems and monitored through the monthly reports.

In the Freight Business, similarly, sub-divisions to Sectors, and profit centres may be identifiable in the provision of Freight train services. For example, the revenue from major flows of traffic is readily identified from the consignment documentation. The present lack of more specific information leads to an spreading of the costs of providing the freight service over all freight traffics regardless of the individual costs which could be attributed to that traffic if the service provided on a more specific basis. Thus it is not possible to determine with any accuracy the profitability of any particular freight traffic flow as all costs have been spread as "average costs".

#### Identification and Allocation of Costs

A clearer understanding of how costs arise, and of asset utilisation will help to identify any over provision of facilities, and point the way toward a more profitable railway. Costs on a railway arise and change in several different ways, depending on the nature of the cause of the cost.

The cost of fuel to provide a train service varies directly and immediately with the weight of the train and the distance travelled. Any change in either of these factors will have an immediate effect on the cost of providing the service. However, a change which reduces the number of train crew, locomotives or vehicles required to operate the service will take longer to work through, since they may not be displaced immediately. Similarly, if the number of trains run in the service is increased, then number of units required to operate it may not increase as there may be sufficient spare capacity within the present allocation to encompass the change. Thus the change in costs may be a "step" change.

In the case of civil engineering and signalling costs, then part of these costs, relating to the maintenance of such basic items as the route formation, bridges, embankments and signalling systems do not vary with changes in the volume of traffic, whereas the maintenance of track does vary, but in "step changes" according to the gross tonnage and speed over each section.

Using the Railway's accounting system, the basis of the cost identification of these input units is the Cost Centre or local cost production area. An Integrated Accounting System provides both Financial and Management Accounts through a budgetary control and monitoring system.

The objective is to break the business down into manageable portions, where the income can be measured, and the costs traced back to small identifiable units of input.

Ideally, the cost centres within any department or function should be of such a size that the costs are specifically related to only one profit centre. However, a "manager", at any level of the organisation, can have any number of cost centres within his own local area of control if they are necessary to identify costs to a number of different profit centres which are served by his function.

For example a Station-master would have a separate cost centre for train signalling staff, another for staff dealing with passenger ticketing, one for other passenger duties, and separate cost centres for work in connection with freight traffic. Staff will be identified to these cost centres according to the duties that they perform. It may, in certain circumstances be necessary to apportion a percentage of staff and other costs between cost centres, by identifying the portion of their work time or some measure of the output that is appropriate, and so allocate the joint cost to different profit centres. As a last resort the cost of administration of the stationmaster's area may require to be identified in a separate cost centre and then those costs spread over all the other cost centres in the area as a % oncost.

In the Locomotive Department, which accounts for approximately 33% of UTY's working expenses, there are 3 main sources of cost. They are: 1) Train crew 2) Provision and Maintenance of Traction 3) Fuel for Traction. Each of these expenditure categories should have separate groups of cost centres as the costs are allocated in different ways.

- It is possible to identify the number of men at each depot required to work each group of services (or profit centre) and due allowance can then be added for spare or relief train crew cover as required. Where a roster covers more than one service group then the cost of the roster may be apportioned according to the proportion of productive work (based on train hours).
- 2) Costs for Provision and Maintenance of Traction are allocated to profit centre according to the number of traction units required to operate the service, as derived from analysis of the diagrams or work schedule, and the derived cost of maintenance"- per kilometre run" for each type of traction used on the various services.
- 3) Fuel Costs should be specific to the type of traction used and the nature of the route and tonnage hauled by the trains within the profit centre.

Similarly, in the Wagon Depots separate cost centres will be created for the different types of vehicles (both passenger and freight) which are maintained thus providing a cost per vehicle which can be charge to the profit centres which require to use these types of vehicle.

In the Civil Engineering and also the Signalling Department separate costs centres can be created for specific sections of the route and also to distinguish between routine inspection and maintenance, and other remedial work undertaken on the section.

As mentioned above, the cost of civil engineering maintenance of the basic railway facility does not vary with the level of traffic. It is therefore necessary to devise a method of cost allocation to the profit centre. In the allocation of costs the approach adopted was to say that the "Prime User" of UTY was the Freight Service (since freight generates 84.7% of the gross-tonne-kilometres on the rail system - 1st half year 1997 operating statistics). Therefore freight should bear all the costs all providing the track, signalling and other infrastructure necessary for the basic freight railway. Any expenditure which is required in addition to this basic facility, by any other business or profit centre (e.g. facilities for Passenger services), would be charged to that business. In this way facilities at depots or terminals provided for a specific traffic would be charge via a cost centre linked to that traffic - for example, connections and siding facilities specifically for Oil traffic would be identified with that Profit Centre (for Oil Traffic).

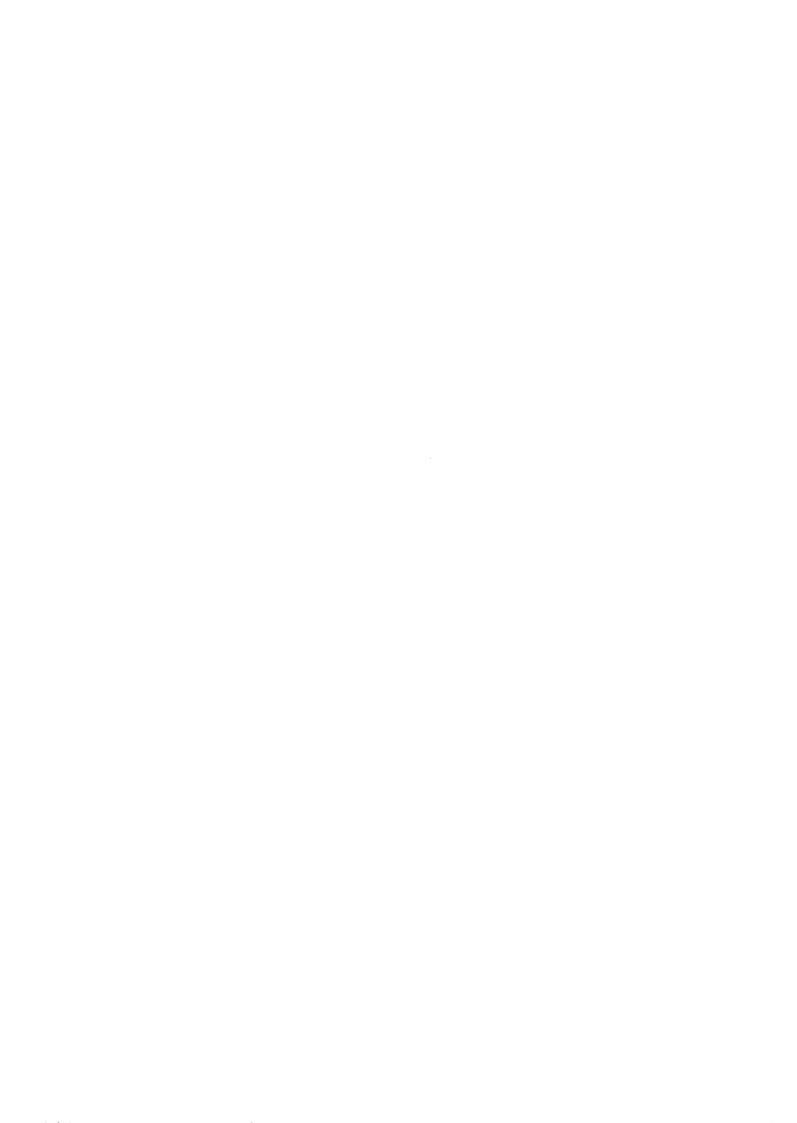
In Headquarters and other Administration Offices, staff whose work can be identified with a specific business activity Passenger, Freight or any other Profit Centre, are to be allocated to a separate cost centre linked to that profit centre. Such an arrangement can apply not only to such examples as Passenger Service Directorate, but also to work carried out by the Accounting Service or the Information Technology/Data Processing functions for work on, say, Passenger Accounting, or processing the payroll for staff who work for the Passenger Business. This more clearly identifies the cost of the individual activity and helps to reduce the residual amount of "general overhead cost" which will require to be averaged over all activities.

All costs incurred by UTY will be accounted for via a 'Cost Centre' and can be compared each accounting period with the Budget prepared for that Cost Centre. Productivity Indicators can also be calculated each Cost Centre. These Productivity Indicators can be used in comparing the work output appropriate to the cost centre. For example a train crew depot could calculate the total number of traincrew man-hours as a ratio of the productive train hours worked from that depot, and the civil engineer can calculate the number of man hours per kilometre of track maintained in the month.

Comparisons can be made between different cost centres, and taking account of local circumstances, improvements sought where individual costs seem to be far out of line with the average for the department.

When a more accurate allocation of costs is available, then it becomes clearer which Profit Centres are contributing to the profitability of the business, and which are the loss makers. This then enables the railway management and the government to see if, and how much subsidy is necessary to keep a particular service open.

It must however be borne in mind, that withdrawing a loss making service will not necessarily mean that all the costs allocated to that service would be saved. There will certainly be some element of joint costs which will remain, and indeed may become a greater burden on the remaining services.



Example of the MAIN ELEMENTS of a PROFIT CENTRE analysis.

EARNINGS	\$(000)	( <b>A</b> )
EXPENSES: Train working:	\$(000)	
Train crews	. xxx	
Fuel & Lubricants	. XXX	
Carriage preparation & cleaning	. xxx	
Shunting Coaching stock	. xxx	
Maintenance of Traction:		
Time based Distance based	. XXX	
Maintenance of Coaching Stock /wagons		
Depreciation/amortisation of Locomotives and Coaches/wagons		
Other Miscellaneous and Specific Expenses		
TOTAL TRAIN WORKING EXPENSES	XXX	<b>(B)</b>
TERMINAL EXPENSES:-		
Operating expenses (shunting loco and crew)	xxx	
Handling of Traffic (loading etc.)	xxx	
Maintenance of Plant and buildings		
Booking and Consignment	XXX	
Miscellaneous		
TOTAL TERMINAL EXPENSES	<u>xxx</u>	(C)

Earnings (A) - (B) - (C) = Contribution to Joint Indirect Costs of Administration and Track and Signalling.

The Train Working expenses will contain an element of the cost of providing buildings and equipment to carry out these functions.

Each line of entry may be the sum of several Cost Centres relating to this Profit Centre. Note: Depreciation and finance charges are excluded from these tables/calculations.



#### 6.7 Financial Accounting Policies in UR

The financial accounting policies of UTY have been the subject of other recent consultancy reports. The position at the time of this present study was a follows:

- UTY adopted a cash based accounting system in 1995 primarily as a basis of reducing its taxation burden on revenue that had been earned but not yet received. This is a common feature of transport enterprises in Uzbekistan.
- The Padeco report referred to many instances of "off-balance sheet" transactions where opening
  and closing figures did not reconcile. This is another indication that normal accounting standards
  and controls are not being applied in the reporting of financial information.
- Asset revaluation undertaken in 1994 following on from the transfer of assets fro Central Asian Railways appear to have been conducted consistently but there has been no further revaluation since this time. There is a lack of consistency in the treatment of depreciation, even under the historical cost basis, and it has been noted that the charges that should have been incorporated in the accounts in 1994 were not included until 1995/96
- Many costs which should be treated as part of operating expenditure are in fact dealt with through funds. The treatment of certain categories of expenditure such distribution of profit rather than as cost distorts the reported profitability.
- Reported gross profit figures in relation to ancilliary services are overstated due to the inclusion
  of internal transactions. Profits made by railway service departments from trading with other
  departments of the railway should be excluded from the accounting results.

# 6.8 Improving the Accounting Systems and Reporting Structures

- It is essential that UTY move rapidly towards the introduction of internationally accepted accounting standards. The existing cash based accounting system is distorting the financial results even though it is advantageous to UTY in delaying tax liability of revenue which has not yet been received and may be regarded as potentially bad debts. The cash based system is also misleading management regarding the current profitability of UTY and will result in a deterioration in the quality of decicison making.
- It is also essential that UTY undertake a realistic revaluation of the fixed assets, taking due account of the condition of the assets and adopting a prudent scrapping policy where possible within the constraints of local legislation regarding the disposal of assets within the term of their original projected life.
- UTY must revise its accounting procedures to ensure that intra-enterprise transactions are eliminated in the preparation of the consolidated financial statements.



- The is a noticable lack of financial information for management decision making purposes within UTY. This situation can only finally be resolved by the introduction of modern financial management information systems and the upgrading of MIS within the enterprise. In the interim it is recommended that consideration be given to the creation of a department who will have responsibility for the preparation of financial analysis for management.
- It is essential that UTY create a traffic costing department which will have specific responsibility for the evaluation of the profitibility of traffic carried. This department should provide information in support of applications for tariff increases and they should assist the marketing department in the negotiation of contract rates for freight traffic.
- The current budgeting procedures need to be updated so that UTY moves away from the outdated concept of the "production plan". It is essential that UTY introduce a more modern approach which involves managers in the planning of the resources that they will require to meet their objectives and the identification of areas where cost reductions can be achieved.

It is recommended that UTY being to develop a new computerised Financial Management System as quickly as possible. The existing computer hardware that is in use by UTY was acquired from Lithuania in the early 1990's and this is now outdated.

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ANNEXE 4 - Tables 1 to 16: BASE

ANNEXE 5 COMMENTARY ON THE FINANCIAL PROJECTIONS



Annexe 1

#### ANALYSIS OF WORKING EXPENSES OF UZBEKISTAN RAILWAYS

#### For the first 6 months of 1997

An attempt has been made to analyse the working expenses of Uzbekistan Railways (UTY) to allocate costs to Freight and Passenger Businesses.

The Transportation Expense and Income for first 6 months of 1997, as reported in an unaudited statement is noted as Soum 5915.4(Million). Income is derived from commercial statistics. Freight Income estimated at Soum 6616 Million (traffic down 25%) and Passenger Revenue Soum 677 Million (down 7%)

Unfortunately verifiable sources of UTY operating statistics, and details of staff numbers and associated expenditure by department, were not made available to the consultants. Therefore the following allocations are on the basis of 'Best Estimates' with the information which it has been possible to assemble from various sources. These include studies carried out within the present consultancy and from other recent consultant's studies of UTY. However it has not been possible to verify or cross check the figures used.

Since only Soum 677Million (9.3%). of the total traffic income of Soum 7292 million for the half-year is derived from the Passenger Business, it has been assumed that UTY is a Freight railway and therefore all expenditure other than that which can be directly attributable to Passenger Business is borne by freight.

The allocation of expenditure within the various departments has been made on the basis of available information. This indicates that the Passenger Business is a serious Loss-Maker. Passenger fails to cover half of the identified 'direct expenditure' attributed o the business.

Annexe 1

# ANALYSIS OF WORKING EXPENSES OF UZBEKISTAN RAILWAYS TO PASSENGER AND FREIGHT BUSINESS

#### For the first 6 months of 1997

Department	Method of Allocation to Passenger Business	Passenger Soum (Millions)	Freight Soum (Millions)	Total Expenses Soum (Millions)
Passenger Department		92.50		92.50
Freight Department			188.10	188.10
Locomotive Department	Staff Numbers by activity, Operating Stats. Train and Loco Km	367.94	1559.16	1927.10
Wagon Department	Staff numbers identified:	425.63	864.17	1289.80
Track	'25% of Maintenance attributable to higher standard required by passenger.	317.70	953.10	1270.80
Civil Construction	Nil identified		139.10	139.10
Signalling and Comms.	25% attributable to higher standard required by passenger.	73.03	219.07	292.10
Electrification + power supply	Nil Identified		112.30	112.30
Operations/divisions	Human resources report: 30% staff to Passenger	181.08	422.52	603.60
TOTALWORKING EXPENSE (Excludes. Deprn).		1457.88	4457.52	5915.40
REVENUE income		677	6616	7293
Operating PROFIT/(Loss)		(781)	2158	1378

Annexe 2

#### NOTE

Uzbekistan Railways (UTY)

Notes to Financial Analysis dated 30.10.97

Financial Analysis based on Financial Accounts for 1996

Projection 1997/2007

Staff numbers as at 31.12.96

Taxation not provided as with depreciation on replacement basis the results are negative

No restructuring costed into projections

No provision for electrification

No investment provided for as the projection is based on current profile

Operating costs are linked to either T/km or Pass/km as applicable

Operating costs not directly related are noted as constant

The splits between passenger and freight are based on the information available at 30.10.97

Period costs (not operational) are as per Padeco report 1997/2007

Accounts payable and receivable on 30 days basis

Depreciation based replacement valuation

Balance of depreciation over historical basis credited to Reserve for Replacement of Fixed **Assets** 

The revenue projections are derived from traffic forecasts

Independent States and Mongolia



Annexe 3

#### **INDEX**

#### Uzbekistan Railways (UTY)

Index to Financial Analysis dated 30.10.97

### Financial Analysis based on Financial Accounts for 1996

#### **Projection 1997/2007**

Profit & Loss Account ( Operations Account )	1
Performance Indicators	
Balance Sheet	
Source & Application of Funds ( Cash Flow )	
Revenue Projections	
Operating Costs (Payroll/Materials/Fuel)	
Operating Costs ( Power/Other/Admin& Other )	
Operating Costs (Operations/Ancilliary Costs)	
Operating Costs (Other Costs/Period Costs)	
Accounts Receivable	
Current Liabilities	
Fixed Assets at historical cost	
Depreciation based on historical valuations	
Work in Progress	
Depreciation on Replacement Valuation	

01.06.98

Uzbekistan Railways

Financial Analysis

Table 1: Profit & Loss Account

Year Ending 31st December Basis

Operating Revenue

Passenger Other Freight

1,987

Total Operating Revenue

2,578

**Operating Costs** 

Maintenance & Repairs Administration & Other Ancilliary costs Materials Electricity Payroll Fuel

Accruals Soum S'000'000 1997 1996 Accruals S'000'000 Soum 1994 1995
Cash Accruals #
Sourn Sourn
S'000'000 S'000'000 S

Soum S'000'000 Accruals Soum S'000'000 Acciuals

2000 Accruals Soum S'000'000 1999 1998

 2001
 2002
 2003
 2004
 2005
 2006
 2007

 Accruals
 Accruals
 Accruals
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22,530 1,392 3,509 1,392 21,266 1,392 3,509 1,392 25,905 25,624 20,723 1,392 3,509 20,420 1,392 3,509 25,321 20,051 1,392 3,509 24,952 17,116 1,392 3,899 22,407 19,030 13,306 1,392 4,332 13,406 4,813 19,61 13,913 1,392 8,913 24,218 13,503 8,339 1,063 4,101

28,180

27,431

26,681

26,166

974 2,821 7,958 2,110 861 722 974 2,821 7,793 684 1,718 844 705 974 2,821 7,625 1,753 2,011 833 693 974 2,821 7,509 1,789 1,990 827 686 974 2,821 7,448 1,825 1,967 820 679 974 2,821 7,382 1,863 1,942 813 672 974 2,821 7,311 1,920 1,909 804 662 974 2,821 7,217 1,979 1,824 780 637 974 2,821 6,973 2,041 1,739 756 612 974 2,821 6,728 2,104 1,742 756 613 974 2,821 6,737 2,140 1,791 771 627 974 2,821 6,878 1,142 1,082 313 323 455 1,247 3,489 195 42 75 133 335

Uzbekistan Railways

Financial Analysis

Table 1: Profit & Loss Account

Year Ending 31st December Basis

Total Operating Costs

Adjustment to cash basis

Operating Profit

Operating Profit

Depreciation

Other Operations profit

Financial Costs

Other costs

Loan Interest

Profit before taxation

2007	Accruals	Will Co.	000.000.s
2006	Accruals	all o'S	s.000.000
2005	Accruals	Solia	S.000.000
2004	Accruals	Sour	8,000,000
2003	Accruals	Soum	2,000,000
2002	Accruals	Soum	2.000.000
2001	Accruals	Soum	8,000,000
2000	Accruals	Soum	8.000.000
1999	Accruals	Soum	2,000,000
1998	Accruats	Soum	2,000,000
1997	Accruals	Soum	000,000,8
1996	Accruals	Soum	S.000.000
1995	Accruais	Soum	000.000.s
1994	Cash	Soum	000.000.s

17,187	8,021	2,971		2,971	1 205	100	467	1,985	3,185		3,185					
16,965	8,021	2,444		2,444	1.205	8	248	1,985	2,576		2,576				+	$\dagger$
16,738	8,021	1,921		1,921	1,205	100	629	1,985	1,972		1,972				-	_
16,594	8,021	1,551		1,551	1,205	9	649	1,985	1,582		1,582		-			
16,535	8,021	1,349		1,349	1,205	100	731	1,985	1,298		1,298	-				
16,470	8,021	1,133		1,133	1,205	100	812	1,985	1,00,1		1,00,1					
16,397	8,021	903		903	1,205	100	651	1,985	932		932					
16,307	8,021	624		624	1,205	100	488	1,985	815		815					
15,989	8,021	-1,603		-1,603	1,205	100	348	1,985	-1,271		-1,271					
15,670	8,021	-4,662		-4,662	1,205	100	211	1,985	-4,193		-4,193					
15,746	8,021	-4,157		-4,157	1,205	100		1,985	-3,477		-3,477					
16,002	352	7,865	2,650	5,215	3,209	3,378		1,985	612	583	29	1928			155	
8,051	276	5,176	1,541	3,635	1,518	529		1,653	3,241	1,212	2,029	1,828				
111.	22	1,445	H	1,445		24		15	1,514	361	1,153	431	44	480	78	118

						3 185	-112	3.073
			-		-	2 576	-2 688	-112
						1.972	4.660	2.688
-	-					1.582	-6.242	-4,660
						1.298	-7.540	-6,242
						1,001	-8,541	-7,540
						932	-9,473	-8,541
						815	-10,288	-9,473
						-1,271	-9,017	-10,288
						-4,193	-4,824	-9,017
						-3,477	-1,348	-4,824
1928			155		-12	-2,066	718	-1,348
1,828					515	716	2	718
431	44	480	78	118		2		2



Retained profit for year Retained profit from last year Retained profit carried forward

Investment of profit in W.I.P.

Profit after tax

ă

Input to Road Fund

Housing

Penalties Employee incentive fund

Capital allocation

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

CHAPTER 6 - ANNEXE

# Financial analysis and Contro

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01.06.98

Table 2

Uzbekistan Railways

Financial Analysis

Performance Indicators

Freight ton/km ( millions ) Passenger km ( millions ) Freight ( soum/ton - km ) Converted ton-km/staff Passenger Tarriff ( Working Ratio Operating Ratio Number of Staff soum/pax-km)

2007	22 281	2 020	1017	0.04			41.723	187	2	0.61	0.89	
2006	21.557	2.029	105	0.686			42,575	1 97		0.62	0.91	
2005	20,817	2,029	1.05	0.686			43,444	2.09	500	0.03	0.93	
2004	20,310	2,029	1.05	0.686		300	44,330	2.18	0.63	3	0.94	
2003	20,042	2,029	1.05	0.686		AE SOF	40,233	2.26	0.64	5 6	0.85	
2002	19,753	2,029	1.05	0.686		16 62A	10,001	2.30	0.64	900	0.30	
2001	19,441	2,029	1.05	989.0		48 076	2 47	74.7	0.65	0 06	20.5	
2000	19,025	2,029	0.00	0.686		49.563	261	10.0	0.00	96.0		
1999 17 066	0000	2,023	0.00	0.080		151,096	2.85	27.0		1.07		
1998 16 881				000.0	24.000	080'10	3.03	0.82	20.0	1.24		
1997	2 029	0.79	0.686	9	51 006	060	3.02	0.80		1.21		
1996 17,539	2,029	0.79	0.686		51 00g	200	2.91	99.0	200	0.08		
1995 17,839					56 122		3 15	09.0	0.60	0.02		
1994 18,868	5,368	0.11	0.198		56.022	100	167	0.43	0.44	2.11		

Chapter 6 Annexes

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

CHAPTER 6 - ANNEXES

# Financial analysis and Control

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Financial Analysis

Table 3: Balance Sheet

01.06.98	m	20,07 Accruals Soum S'000'000
		2006 Accruals Soum S'000'000
	· ·	2005 Accruals Soum S'000'000
		2004 Accruals Soum S'000'000
		2003 Accruals Soum S'000'000
		2002 Accruals Soum S'000'000
		2001 Accruals Soum S'000'000
		2000 Accruals Soum S'000'000
		1999 Accruals Soum S'000'000
		1998 Accruals Seum S'000'000
		1997 Accruals Soum S'000'000
		1996 Accruals Soum S'000'000
		1995 Accruals Soum S'000'000
		1994 Cash Soum S'000'000

80,092	82,293
70,956	73,096
62,428	64,506
2,036	56,528
46,932	48,946
39,657	41,648
30,650	32,617
21,715	23,651
13,057	14,784
1,450	8,002
2,678	4,175
1,971 7,032 3,137	12,140
882 6,015 1,645	8,542
587 2.454 346	3,387
<del></del>	_

	L	10.097				6 29 107		111 400	3,
	39,20	9.298	29.90			29,906		103 002	3
	39,204	İ	30,642			30,642		95 149	
	39,204	7,884	31,320			31,320		87.848	
	39,204	7,259	31,945			31,945		168'08	
	39,204	6,684	32,520			32,520		74,168	
	35,189	6,155	29,034			29,034		61,651	
011	91.19	2,668	25,451			25,451		49,103	
37 500	666,72	9.2.6	72,380			22,380		37,164	
24 180	201, P.2	4,000	18,003		2000	19,383	27.000	1986,12	
18 909	4 425	VAN N.	7		70777	14,464	10 050	60001	
12 884	4 073	118	30.0	0,020	14 036	14,030	126 95	10/0/03	
11,492	3 780	7712	2,727	-1,-,-	10.430	SCF.01	18 981	100'0	
7,308	2.368	4 940	1 072	1	6.012	2,0,0	9 399	2001	
_	L	1_	L	ل	L	J	L	١	

Accumulated Depreciation Net Assets Work in Progress

Total Fixed Assets

**Total Assets** 

Cost

Accounts Receivable Other Current Assets

**Current Assets** 

Total Current Assets

**Fixed Assets** 

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

CHAPTER 6 - ANNEXF

# Financial analysis and Contro

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Uzbekistan Railways

Financial Analysis

Table 3 : Balance Sheet

Accounts Payable

**Current Liabilities** 

Long Term Loans

Total Liabilities

Net Value

Total Current Liabilities

2006 2007 Accruals Accruals 2005 Accruals 2004 Accruals 2003 Accruals 2002 2001 2000 Accruals Soum \$1000,000 S.000.000 Accruals Soum 1999 Soum S'000'000 Accruals 1998 Accruals Soum S'000'000 1997 1996 Accruals Soum Soum Soum S'000'000 S'000'000 Accruals Soum 1994 Cash

10,148 1,376 1,376 13,532 11,524 1,355 1,355 12,177 17,555 15,540 1,334 1,334 14,207 16,236 1,319 1,319 1,311 20,295 18,266 19,577 1,311 1,303 21,598 1,303 1,294 16,280 17,574 1,294 12,210 1,282 1,282 13,492 8,690 9,940 1,250 1,219 5,280 6,499 1,220 1,220 1,220 13,730 5,271 13,730 3,708 7,464 7,464 2,733 2,733 1,985

44,077 52,570 61,315 70,293 79,609 89,470 99,876 35,611 27,224 20,886 17,439 13,246 6,666 11,517

8,549 6,045 3,073 82,209 8,549 6,045 -112 8,549 6,045 -2,688 67,703 8,549 6,045 -4,660 60,359 8,549 6,045 -6,242 52,962 8,549 6,045 -7,540 45,516 8,549 6,045 -8,541 38,024 6,549 6,045 -9,473 30,490 8,549 6,045 -10,288 22,918 8,549 6,045 -9,017 15,310 8,549 6,045 4,824 7,669 8,549 6,045 -1,348 7,802 2,997 718 6,607

99,876

89,470

609,62

70,293

61,315

52,570

44,077

35,611

20,886 27,224

17,439

13,246

11,517

999'9

Value

Reserve for Replacement of Assets Gov. Subs. for new construction

Retained Earnings

Funds & Reserves

Represented By:

Capital

Usbekistan Railways

Financial Analysis

Table 4: Sources & Application of Funds

Accruals Soum S'000'000
2006 Accruals Soum S'000'000
2005 Accruals Soum S'000'000
2004 Accruals Soum S'000'000
2003 Accruals Soum S'000'000
2002 Accruals Soum S'000'000
2001 Accruals Soum S:000:000
2000 Accruals Soum S'000'000
1999 Accruals Soum S'000'000
1998 Accruals Soum S'000'000
1997 Accruals Soum S'000'000
1996 Accruals Soum S'000'000
1995 Accruals Soum S'000'000
1994 Cash Soum S'000'000

2,971 1,985 -1,205

2,444 1,985 -1,205

1,921 1,985 -1,205

1,349 1,985 -1,205

8,021

8,021 10,723

8,021 10,352

8,021

11,245 8,021

10,150

0

13,949 10,150 10,352 10,723 11,245 11,773

12,945 13,775

10,608

9,419

4,645

8,193

9,318

10,546

Total Sources

Funds From Operations									
Operating Profit	1,424	3,635	5,215	-4,157	-4,662	-1.603	624	506	1 133
Profits from other operations	15	1,653	1,985	1,985	1,985	1.985	1 985	1 985	1 085
Less Period Costs	0	-1,518	-3,209	-1,205	1 205	-1 205	1 205	1 205	200
Financial income	54	0	0				2071	503,1	507
Depreciation	2,368	1,412	352	8,021	8,021	8,021	8,021	8.021	8.021
	3,861	5,182	4,342	4,645	4,139	7,198	9,425	9,705	9.934
+ 1 · · · · · · · · · · · · · · · · · ·									
Short Lerm Loans	_	-1	0			-		-	
Long lerm Loans Received					5,280	3,410	3.520	4.070	4 015
,								3	2
Government Sub. vet for new constitu	9 <u>2</u>	2,941	3,104						
Statutary Funds & Reserves	6'92	1,195	747				-		
					_	-	-	_	

Uzbekistan Railways

Financial Analysis

Table 4: Sources & Application of Funds

 
 2001
 2002
 2003
 2004
 2005
 2006
 2007

 Accruals
 Accruals
 Accruals
 Accruals
 Accruals
 Accruals
 Accruals

 Soum
 Soum
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 S'000'000
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 S'000'000
 2,000,000 Accruals 2000 Soum \$1000,000 Accruals Soum 1999 \$1000,000 Accruals Soum 1998 S'000'000 Accruals Soum 1997 8,000,000 Accruals Soum S.000.000 S.000.000.S Accruals Soum 1995 Cash Soum

4,015.0

4,070.0

3,520.0

3,410.0

5,280.0

1,391 1928 3,298

1,313

7,308 911 1,072

Application of Funds

Investment of profit in W I P W.I.P. construction Capital Expenditure

Total Capital Expenditure

Road fund / Incentives/Penalties Financial (exchange rates) Loan Principle Repayment Change in Working Capital Income Tax paid Loan Interest

Total Application of Funds

Net Cash Flow for Year

Cash in hand at start of year

Cash in hand at end of year

100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         100         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030         2.030 <th>0</th> <th>6,617] 0] 5,280</th>	0	6,617] 0] 5,280
488         651         812         731         649         629         548           0         0         0         2,030         2,030         2,030         2,030           178         18         16         15         14         28         40           0         0         0         0         0         0         0         0           0         0         0         0         0         0         0         0         0           4,287         4,839         4,943         2,875         2,793         2,786         2,718           8,658         8,935         9,006         7,275         7,560         7,936         8,528           13,057         21,715         30,650         39,657         46,932         54,491         62,428         70,956	3,378 100 100	
0         0         0         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         2,030         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	0 0 211	
178   18   16   15   14   28   40   40   60   60   60   60   60   60	o	0
0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0	3,628 3,838 -47	
4,287   4,839   4,943   2,875   2,793   2,786   2,718	583 0 0	0
4,287         4,839         4,943         2,875         2,793         2,786         2,718           8,658         8,935         9,006         7,275         7,560         7,936         8,528           13,057         21,715         30,650         39,657         46,932         54,491         62,428         70,956	155 0 0	0
8,658         8,935         9,006         7,275         7,560         7,936         8,528           13,057         21,715         30,650         39,657         46,932         54,491         62,428         70,956         8	7,105 3,938 5,544	5,544
13,057   21,715   30,650   39,657   46,932   54,491   62,428	1,088 707 3,875 6	707 3,875
21,715 30,650 39,657 46,932 54,491 62,428 70,956	883 1,971 2,678 (	1,971 2,678
	1,971 2,678 6,553 1	1 2,678 6,553



FINAL REPOR

CHAPTER 6 - ANNEXE

# Financial analysis and Control

88.80.FU

40

2007 T/km

2006 1/km

2005 7,km

7km 1km

2003 T/km

2002 T/km

2001 T/km

2000 T/km

1999 1/km

1998 1/km

1997 T/Km

1996 T/km

Uzbekistan Raliways

Financial Analysis

Table 5 : Revenue Projections

Freight - Tonne Kilometres (millions)
Conmodity
Stone coal
Coke
Coke
Petroleum
Ores
Black Metals
Timber
Construction Materials
Fertilisers
Grain
Cotton
Other
Total

946 0 26 0 9 164 0 424 0 424 0 424 0 424 0 464 10 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2533 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534 0 2534

946 0 26 0 8 854 0 416 0 195 0 1 820 0 2 890 0 1,649 0

946 0 26 0 408 0 406 0 189 0 4 354 0 1 676 0 2 346 0

982 0 8 26 0 8 285 0 402 0 409 0 163 0 1,63 0 2,042 0 2,042 0 2,042 0 2,042 0 2,042 0 2,042 0 2,042 0 2,042 0

1,006 0 8,190 0 400 0 4172 0 1,690 0 1,695 0 1,655 0 19,753 0

1,029 0 8,107 0 8,107 0 398 0 4,126 0 1,729 0 1,729 0 1,729 0 1,729 0 1,729 0 1,729 0 1,729 0 1,729 0

1,053.0 26.0 8.013.0 396.0 419.0 1,558.0 1,558.0 1,650.0 19,025.0

792 0 22 0 7.740 0 384 0 418 0 170 0 3.914 0 1.536 0 3.650 0 17.955 0

519 0 6 915 0 371 0 416 0 16 10 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,512 0 1,51

506 0 16 0 7,027 0 375 0 409 0 166 0 3 833 0 1,506 0 3 803 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606 0 1,606

507 0 16 0 7,311 0 392 0 392 0 414 0 174 0 176 0 1,076 0 1,788 0 17,539 0

958 0 26 0 8.368 0 402 0 402 0 402 0 402 0 185 0 1,611 0

21 557 0

2.1840

0 908 0 908 0 597 0 708 0 997 0 901 1 020

0 908 0 908 0 597 0 708 0 397 0 631 0 501

0.861 0.908 0.597 0.597 0.397 1.020

0.861 0.908 0.597 0.597 0.597 0.397 1.020

0 861 0 908 0 597 0 708 0 397 0 901 1 020

0 908 1 575 0 602 0 597 0 397 0 631

0 861 1 575 1 575 0 602 0 708 0 397 0 901 1 020

0 861 0 908 0 597 0 597 0 397 0 901 1 020

0 783 0 825 1 432 0 543 0 643 0 361 0 819 0 927

0 652 0 688 1 193 0 455 0 455 0 301 0 683 0 772

0 688 1 193 1 193 0 455 0 536 0 301 0 683 0 772

0.683

0 652 1 193 0 456 0 456 0 301 0 478

Sour

Soum

10%

20%

14,431

24 13.943 250 248 138 1 789

814 24 246 242 242 1,729 1,058 2,114 2,114 1,657

24 24 242 242 242 242 1691 1,691 1,968 1,968 1,655

24 13,047 242 244 130 1,674 1,674 302 1,671

24 24 12,910 241 247 128 1,657 1,703 1,03 1,687

24 24 240 240 240 248 127 1,763 1,538 1,703

906 24 24 12,618 250 250 1,596 1,404 1,693

620 10,708 210 210 1,413 1,529 1,529

338 1249 169 169 90 1157 1032 1243 1278

8 383 171 185 185 1 153 1 028 1 232 1 2994

93 1,208 514 1,054 226 1,389

8,722 1/9 187

331

297 297 297 297

2 199 295 1 681

Tariff Increase %

Stone coal
Coke
Coke
Petroleum
Ores
Black Metals
Timber
Timber
Construction Materals
Fertilisers
Grain
Cotton
Other Tariff

Freigh Revenue (Millions Soum)

Stone coal Coke Petroleum Ores Black Metals

Construction Materials Fertilisers Grain Cotton Other

Total Freight Revenue

23,279	
22,530	
21,780	
21,266	
21,004	
20,723	
20,420	
20,051	
17,116	
13,306	
13,406	
13,913	
	1

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Chapter 6 Annexes

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

FINAL REPOR CHAPTER 6 - ANNEXE

# Financial analysis and Contro

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6

Uzbekistan Railways

Financial Analysis

Table 5: Revenue Projections

Passenger Revenue Passenger Kms (millions) Passenger tariff ( S/km ) **Passenger Revenue** 

Industrial Sales Passenger Station Services Loading Services Passenger Train Services Freight Forwarding Capital Repairs
Distribution Services
Other Revenue Other Revenue Other Services

	2007	3	1/Km				2 029	OFBE	1 303	7001			R51	5	B	37	25	32	207	5	257	1,654	3.509	
	2006	The	) VIII				2,029	0 686	1 392				851	9	3	37	25	22	204		707	1,654	3,509	
	2005	T/km					2,029	0.686	1.392				851		3	3/	25	22	594	120	/67	1,654	3,509	
	2004	T/km				0000	2,029	0.686	1,392				851	69	150	7	25	22	594	257	100	1,654	3,509	
	2003	T/km				0000	2,023	0.686	1,392			130	821	69	37	5	52	22	594	257	1 55.1	1004	3,509	
0000	2002	T/km				2 020	200	0.080	1,392			064	100	69	37		63	77	594	257	1 651	100	9,505	
2004	7001	I/km				2 029	2000	0000	1,392			851	3 8	â	37	30	3 8	775	294	757	1 654	2 500	2021	
2000	2000	mx/				2,029	ORRE	7	766'			851	08	S	37	25	32	277	0.00	707	1.654	3.509		
1999	The	1				2,029	0.686	1 302	1			946	77		41	28	24	661	200	507	1,838	3,899		
1998	T/km				0000	5,029	0 686	1.392				1,051	85	3/2	2	31	27	734	317		2,042	4,332		
1997	T/km				2020	5,029	0.686	1,392			1 403	/91/	94	5.4	5   3	34	30	815	352	0000	5,203	4,813		
1996	T/km		-		2000	2007	0 686	1,392			2 167	7017	175	94	3	3	55	1,510	652	7 202	7,502	8,913		

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Uzbekistan Railways

Financial Analysis

Table 6: Operating Costs Payroll (inclusive of social fund)

Passenger
Freight & Commercial
Traffic Operations passenger 25%
Traffic Operations freight 75% Annual Staff Reduction Index

Locomotives passenger 25% Locomotives freight 75% Wagons passenger 33% Wagons freight 67% Signal & Comms
Electrification & P S
R W Region
Management Civil Engineering Track

Total Payroll Costs

		2,000,000	100	% 7-		5	918	2 67	143.2	200	200	247.8	14/3	202.0	7020	200	67	135.5	340	16.4	82.9	1,649.9
9000	2000	2000,000	ì	%7-	1	100	93.6	50.5	146.1		8/4	252.8	147.9	280.6	0 607	3030	, ,	38.3	34 7	191	846	1,683.6
SOME	500	2000,000	/00	0/ 7-		3.4	95.5	515	1 671	200	- 60	2580	1509	295.5	0000	200	9/	141	35.4	17.1	863	17179
2004	500	2000,000	700	0/ 7-	000	32.0	97.5	52.6	152.1	0.00	0.10	7037	154.0	301.5	315.5		000	0 00	30.2	17.4	1 88	1,753.0
2003	000 000	2000	700-	2	300	35.0	38.5	53.6	155.3	g C0	0 70	0 007	157.1	307.7	2210	Ca	700	0.00	600	17.8	6 68	1,788.7
2002	000000	000,000	%C-		33.3	200	2012	54.7	158 4	2 76	27.4	1 4/7	160.3	313.9	3285	6 9	1400	27.5	2	18.1	91.7	1,825.3
2001	000 000.5	200,000	-3%		34.0	0 000	103 6	559	1617	7 96	7 076	2131	163.6	320.3	335.2	A S	153.0	7 05	200	18.5	93.6	1,862 5
2000	5:000 000	200,000	-3%		35.0	100 0	0 00.1	57.6	166 7	9 66	288.3	2007	1686	3303	345.5	8 8	157.7	30.6		19.1	96.5	1,920.1
1999	S:000 000	Т	-3%		36.1	1101	01	59.4	1718	102 7	297.3		1/38	3405	3562	0.6	1626	40.8	2	/6/	99.5	1,979.5
1998	S.000 000		.3%		37.2	113.5	2	612	1771	1059	306.5	0.00	76/1	3510	367.2	93	167.6	421	1 2	\$ 2	102 5	2,040.7
1997	S:000 000				38.4	117.0		63.1	1826	109.2	315.9	0 707	104 0	3619	3786	96	1728	43.4	000	607	105 /	2,1038
20/26	Projection	Basis			1997 base	1997 base	1004	1997 Dase	1997 base	1997 base	1997 base	1007 5250	aspr 1661	1997 base	1007 1001	aspo icci	1997 base					
1996	S:000,000	Total			38.4	1213		3	1893	109 2	327 5	184 8	0 10	3/51	3786	96	1728	43.4	0000	, ,	/ CDL	2,139.7
1996	8,000,000	Social			107	33.7	17.5	2	976	303	910	513		104.1	105 1	27	480	121	9		634	594 5
1996	2.000.000	Labour			27.7	876	AS B		1367	/89	2366	133.5		7/10	2735	69	1248	313	0 7 1	2 2	20,	1,545.2



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Uzbekistan Railways

Financial Analysis

Table 6 : Operating Costs Payroll ( inclusive of social fund )

Materials

raffic Operations passenger 25% Traffic Operations freight 75% Locomotives passenger 25% Locomotives freight 75% Wagons passenger 33% Freight & Commercial Wagons freight 67% Passenger

Electrification & P.S. Civil Engineering Signal & Comms R W Region Track

Total Materials Cost

Fuel

Traffic Operations passenger 25% Traffic Operations freight 75% Locomotives passenger 20% Locomotives freight 80% Wagons passenger 33% Freight & Commercial Wagons freight 67% Civil Engineering Passenger Track

Total Fuel Costs

Electrification & P S

R W Region

Signal & Comms

Management

	2007	S.DOO DOO					2.4	4.8	47	17.9	689	259.2	87.0	2243	1430	9 0	9 4	17.0	9		-	, , ,	0//4		6	70		0 0	3318	1,686.0	300	77.4	217	38	52	26	-	12	2 167 6
	2006		Т			,	7.4	4.8	4.7	17.3	089	250.7	87.0	217.0	143.8	101	38.6	17.6	0.9	2	,	961	00		50	101		3.8	331.8	1,6312	30.0	74.9	21.7	38	52	26	18	12	2 4 40 2
	2005	S:000.000				,	7	47	47	167	089	242 1	87.0	209 5	143.8	9	26.6	17.6	0.9	2		844.4			00	60	0	36	3318	1,5753	30 0	723	217	3.8	52	26	18	12	2051.5
	2004	S.000,000				100		4 /	4.7	16.3	0 89	236 2	87.0	204.4	143.8	101	26.6	176	0.9	51		8329			0.2	60	10	36	331.8	1,5369	300	705	21.7	3.8	5.2	2.6	1.8	12	20112
		2,000,000				24	-	4	4 /	16.1	680	233 1	87.0	201.7	143.8	10.1	26.6	176	0.9	5.1		826.9			0.2	60	1.0	3.5	331.8	1,5166	300	969	217	3.8	5.2	26	1.8	12	1,989.9
2000	Т	S.000,000				24	47	,	1 6	159	680	2298	87.0	1988	143.8	101	26.6	17.6	6.0	5.1		820.4			0.5	60	+0	3.5	3318	1,494.7	000	000	717	3.8	5.2	26	18	12	1,967 0
7000	1002	2 000 000				2.4	47	17	7 0	000	0 80	1977	0./8	282	143.8	10.1	566	176	0.9	5.1		813.4			0.2	60	0	3.4	331 8	300	3000	2 2 2	7 000	200	700	97	20.0	7-	1,942.3
0000	000,000.5	2000,000				24	4.9	47	153	0 00	0000	2213	0 0	1910	143.8	101	907	9 0	0	5.1		8042			0.2	60	1.0	334.0	1 430 6	3000	1 99	217	3 8	0 4	35	0 7	0	7-	1,909.2
1999	1	┰				24	49	47	14.4	6A O	208 B	87.0	7 001	9674		996	20.0	0 4		0	000	700/			700	800	0 -	331.8	1 35g 7	30.0	623	217	3.8	52	26	9	2 0	,	1,824.3
1998	S'000 000	202				2.4	46	47	136	089	1963	87.0	169 9	143.8	- 0	38.6	17.6	9	2 4	-	756.7	/ 00/		0	700	-	0 0	331.8	12774	30.0	586	217	38	52	26	- 8	12		1,739 1
1997	8,000,000	Т			1	7	4 4	47	136	089	1968	87.0	1703	1438	101	26.6	17.6	0.9	2		756.A	7		0.0	800		30	3318	1,280.2	30 0	587	21.7	38	52	26	18	12		17420
97/07	Projection	Basis			Pacc/km	The		Pass/km	T/km	Pass/km	T/km	Pass/km	T/km	constant	constant	constant	constant	constant	constant					Pass/km	T/km	Pass/km	T/km	Pass/km	1/km	Pass/km	T/km	Constant	Constant	Constant	Constant	Constant	Constant		
1996	000,000	Total			24	9 9	, ,	4 /	14.1	089	204 0	87.0	1765	1438	101	266	17.6	09	51		770.5			02	0.8	10	31	3318	1,327.2	300	_	-+	38	-	_	-	12		1,791.3
1 1	8	Social			-				+																							-	-					1	
	3	Labour										1	1																										



TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

FINAL REPORTHANTER 6 - ANNEXE

# Financial analysis and Contro

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Uzbekistan Railways

Financial Analysis

Table 7: Operating Costs

Power

Passenger
Freyllt & Communical
Inflic Operations passenger 25%
Traffic Operations treight 75%
Locomotives passenger 11%
Locomotives freight 89%
Wagons passenger 33%
Wagons passenger 33%
Civil Engineering
Signal & Commis
Electrification & P.S.
R.W.Region
Management

Total Power Costs

	2007	800			243	34.9	230	87.8	38.6	360	3/0.0	105	27.1	16.6	200	2 88 5	3	93	3.3	25		739.1
	2006	S,000,000		24.2	643	33.8	23.0	849	36.6	263.0	200	105	262	16.6	27	88.5	2 4	c	3.3	25		722.0
	2005	S,000,000		243	200	37.0	230	820	366	3513	200	000	253	166	27	885	5.3	3	33	2.5		7046
	2004	000'000's		243	010	5 6	23.0	900	366	3428	10.5	2	24.7	16.6	27	88.5	53		3.3	2.5		692.6
	2003	8,000,000		243	718		0.62	78.9	36.6	338.3	10.5		243	16.6	2.7	88 2	53	000	200	7.2		6863
0000	7007	S 000 000		243	31.0	23.0		8 //	36.6	333.4	10.5		740	166	2.7	88.5	5.3	3.3	2	C.7		679.4
,000	1002	2,000,000		24.3	30.5	23.0		49/	36.6	328.1	10.5	326	000	166	2.7	88.5	5.3	33	36	2 3		0/71
0000	200	3,000,000		243	298	230	710	000	900	321.1	105	23.1	0 07	0.0	/7	88.5	5.3	33	25		6622	007.3
1999	ا	ı	27.0	543	28.2	23.0	707	35.6	30.0	303.0	10.5	218	16.6	200	7700	0 0	5.0	33	25		6370	2
1998	S 000 000	000,000,0	24.3	2 1 2	40.5	230	665	36.6	284.0	504 3	0.01	205	16.6	27	200	000	200	3.3	25		6117	
1997	S 000 000	1	243	2 2		23.0	999	36.6	285.5	200	2	206	16.6	27	AB 5	52		33	25		6125	
			Pass/km	1/km		rass/km	EW/	Pass/km	T/km	Pace/km	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	/km	Constant									
1996	8,000,000		243	27.5	0.60	730	169	366	2960	10.5	2.50	513	166	27	88 5	53	33		25		627.2	



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# TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

Uzbekistan Railways

Financial Analysis

Table 7: Operating Costs

Other Costs

Freight & Commercial Traffic Operations passenger 25% Traffic Operations freight 75% Locomotives passenger 25% Locomotives freight 75% Wagons passenger 33% Signal & Comms
Electrification & P.S.
R.W. Region
Management Wagons freight 75% Civil Engineering Track

Total Other Costs

Property Tax Administration & Other

Land Tax
Water use & other taxes
Services from 3rd parties

Total Administration & Other

200/ 200/ 200/ 200/		28 1	1777	1491	1699	6476	519.9	1,3409	1,028.2	251.1	127.2	716	320	2	4,639.9		470.7	702	3 2	508		0730
2006 S.000,000		28.1	1/19	1443	1699	9.929	5199	1,297 3	1,028.2	251 1	127.2	97.5	32.0		4.564.6		478.2	100	34.7	6605		973 A
2005		28.1	39 -	139 3	169 9	605 1	5199	1,2528	1.028 2	2511	7 / 7 / 7	37.3	320		4.487.7		1782	100	347	9099		973.8
2004		1620	39.1	1359				1,020.3	7 970'1	1 107	2 17	37.3	32.0	300	4,435.0		178.2	100 4	34.7	9099		9738
2003		1599		134 1	6691	287.5	9001	1 000 2	251 4	127.2	917	37.3	32.0	4 407 2	7,104,4		178.2	100 4	34.7	660 5		9738
2002	28.4	1576		132.2			1 188.8	1 028 2	251.1	127.2	91.7	37.3	32.0	4 377 3	7		178.2	100.4	34.7	909	0.770	3/38
2001 S.000.000	28.1	1551	39.1	130	1		1,1700	1,028 2	251.1	127.2	91.7	37.3	32.0	4.344.7			178.2	1004	34.7	C 099	0770	22.2
2000	28 1	1518	39.1	160 9	5530	5199	1,1449	1,028 2	251.1	1272	917	37.3	32.0	4,3015			178.2	1004	34.7	0000	973 A	
1999	28 1	143.2	39 1	169 9	5219	519.9	1,080 6	1,028 2	251.1	127.2	917	373	35.0	4,1903		0.55	7,87	24.7	54 / BEO F	2000	9738	
1998 S,000,000	28.1	134 7	1130	6 691	490 7	5199	1,0159	1,028 2	2511	127.2	917	37.3	25	4,078 7		4707	7007	34.7	660.5		9738	
000'000'S	28 1	1349	113.2	169 9	4917	5199	1 018 1	1,028 2	1 107	7/7/	37.2	320		4,082 6		17A 2	100 4	34.7	999		9738	
	Pass/km	Pass/km	1/km	Pass/km	T/km	Pass/km	l /km	constant	Constant	Constant	Constant	constant				constant	constant	constant	constant			
1996	28.1	39.1	1174	169 9	509 8	6610	0 000	2502	127.2	917	37.3	32.0		4,147.1		1782	1004	34.7	9 099		973.8	



973.8

9738

9738

Uzbekistan Railways

Financial Analysis

Table 8 : Operating Costs

Repair Fund Depot Repairs of freight wagons

Total Maintenance & Repairs

Ancilliary Costs

Passenger Station Services
Loading Services
Passenger Train Services
Freight Forwarding
Other Services
Capital Repairs
Distribution Services Industrial Sales

Total Ancilliary Services

	2007		2,000,000	2 139 3	6819	0,000	7,128,2			1.483.0	1110	673	2 /2	75.0	30.5	0073	0 7 0	5/1.0	4,978.6		7 050 7
	2006	0000	3000,000	2,1393	6189	0,000	7 7077		0 000	1,483.0	1110	EK -	3	750	29.5	0 0 0 0	0.450	0.170	4,816.8		7 703 4
	2005	000	2000	2,1393	6819	2 924 2	7 1707		0 707	1,483.0	110	629	6 70	06/	28.5	0 643 0	67.0	01/6	4,651.5		7 624 B
	2004	000 000.5	3	2,1393	6819	28212	7 170'7		1 402 0	1,403.0	110	614		00/	27.8	6420	5710	2/10	4,538.2		7 509 3
	2003	8:000 000	200,000	2,139.3	6819	2 821 2			1 482 0	2000	110	9 09	-	0.07	27.4	6420	5710	2	4.478.3		7 448 3
	2002	000 000,5	200	2,1393	6819	2 821 2			1 483 0		111.0	59.7	75.0	000	27.0	6420	5710		4,4137		7,382.4
	2001	8,000,000		2,139.3	6819	2.821.2			1 483 0		0	28.7	75.0	2	997	6420	5710		4 344 0		7,3113
	2000	8,000,000	2 000	2,139.3	6819	2.821.2			1.483.0			57.5	75.0		790	642.0	5710	4 26 4	0.107,4		7,2166
	1999	S.000,000	2 120 2	2,139.3	6819	2,821.2			1,483.0			543	75.0		24.0	6420	571.0	0 0 0 0 0	4,012.0		6,9728
	1998	000,000's	2 130 3	2,1333	6184	2,8212			1,4830	0111		510	75.0	300	23.1	6420	5710	3 773 0	0.77.20		6,7281
.000	/661	000 000.S	2 130 3		6 100	2,821.2			1,4830	1110		110	75.0	23.7	707	6470	5710	3 780 2	3	1	6,736.5
			constant	There	1				constant	Pacs/km		1/KIII	Pass/km	T/km		constant	constant	1/km			
1006	1990	S:000,000	2.139.3	6810	6100	2,821.2			1,483.0	1110	0 0 0	0.50	15.0	24.0	0000	0.750	5710	3 9 1 9 0		0 07.0	0,0/6.0



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CHAPTER 8 - ANNEX:

# Financial analysis and Contro

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Uzbekistan Ralways									-	_			: .			96 90
Financial Analysis																
Table 9 : Operating Costs		·											-			· Ø
Other Costs (Period Costs)		:		1996												
Excess				000. s		1997	1998	1999	500	2001	2002					
Maint EP facilities				1,4380							7007	2003	2004	2005	2008	2007
Student leave				95,685 0						:	1	:	:			
Training leave	:			926	:					•						
Exec. veh. maintenance	1	ì		335.0						!						
Outside staff				3,583.0		1	!	:								
Gueste treatment		-		440		1										
General training		-		283.0												
Maint of Social facilities		-		A56 783 0											1	
Maint of Ancilliary facilities		<u>                                     </u>		12,1280												
Maint training facilities				1.897 0								-				
Audit		-	:	63,268 0					1		-		1			
Price control fines	-	-		2/80					:			1	1	-	:	
Income Supression fines	:	-		321 184 0									-	-		
Other fines				30,303 0					-							
Loss on sale of FA			i	34 1310					+	+						
Mobile phones	-	:	-	6.0540					-							
Charitable donations	1			49 373 0	•								-	-	1	
Salary differentials		! !		2780	1			:								-
Inventions & enhancements				109 0				•								
13th salary & insurance		-		837 493 0										•		
Out patients care				17,929 0									-			
Additional vacation leave			-	20,156.0						<del></del>	:					
Pensions		-	:	7 084 0		-		•				i	:			
Public transmost				8,878 0	-	!										
Employee discounts	-	:	1	6,8150		1				-						
Employee leave travel		-	-	24 329 0								1	-			
Non Gov paneion fined deduction				3.0760					-							Ī
Materials lost & damaged		!	-	10,2310					:							
Industrial injury payments		-		4 489 0							-			-		
Excess Bank charges			:	3 148 0	. !										-	
Material reserves Other costs				4,7240		<u> </u>	:	: : : : : : : : : : : : : : : : : : : :	-	-						
Administrative costs	-	+		278 898 0				1 :		-	-	+				
Housing	:			437,726.0			:	1	-	1		-	-	+		
Social institutions				3 005 0		: ,						:				
Bonuses & rewards		-		u .		H	:	<u> </u>	:					1 1		
Total Other Costs	:	-	16	0 474 000				:		:	-		-			
		-	2 0	5000000	-						:	!	1	:	:	•
Total Other Costs		-		3,209.4									-			İ
								_	1	-			_		<u> </u>	



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1997/2007 as per Padeco report Uzbekistan Railways

Financial Analysis

Table 10 : Accounts receivable

þ, Accounts receivable at year start

Other receivable at year start b/f

Receipts from sundry operations Freight revenue for year Other revenue

Amount outstanding at year end Payments received during year

Increase/ decrease for year

2007	000	2,140.2		23,279.2	3,509.0		26,726.6	201.8	616
8	8,000			l				2,	L
2006	S,000,000 S,000,000	2,078.5		22,529.8	3,509.0		25,246.6 25,977.2	2,078.5 2,140.2 2,201.8	61.6
2005		2,036.3		21,779.9	3,509.0		25,246.6		423
2004	8,000,000	2,014.8		21,004.0 21,265.6	3,509.0		24,753.1	2,014.8 2,036.3	21.5
2003	8,000,000 S,000,000 S,000,000 S,000,000	1,991.6			3,509.0		24,489.9	2,014.8	23.1
2002	000'000's	1,966.8		20,722.6	3,509.0		24,206.8	1,991.6	24.8
2001	8,000,000	1,936.5		20,420.4	3,509.0		23,899.1	1,966.8	303
2000	000'000'S 000'000'S 000'000 S 000'000	1,727.3		20,051.3	3,509.0		23,351.1	1,936.5	209.2
1999	s,000,000,s	1,449.7		17,1159	3,899.0		20,737.3	1,727.3	277 6
1998	\$,000,000,8	1,497.5		13,406.0 13,305.8	4,332.0		26,890.5   17,685.6	1,449.7	47.8
1997	S,000,000	7,032.0	3,1370	13,406.0	4,813.0	-	26,890.5	1,497.5	- 86715



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CHAPTER 6 - ANNEX:

# Financial analysis and Contrc

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Uzbekistan Railways

Financial Analysis

Table 11 : Current liabilities

Accounts payable at start of year b/f Other payables at start of year b/f Total outstanding at start of year bif

Expenditure during year

Materials

Power Fuel

Admin.& other Other costs

Maintonance & repairs Ancilliary costs Total expenditure with credit

Payments during year

Balance at year end

Increase/decrease for year

2007 S,000,000 1,355.1
2006 S,000,000 1,333.6
2005 S,000,000 1,318.9
2004 2005 S,000,000 S,000,000 7 1,311.1 1,318.9
2003 S,000,000 1,302
2002 S,000,000 1,293.6
2001
2000 S,000,000 1,250 5
1999 S,000,000 1,2193 1,2193
1998 5,000,000 1,220.3 1,220.3
1997 S,000,000 5,271 0 8,459 0

1,355.1

1,333.6

1,318.9

1,311.1

1,302.7

1,293.6

1,281.6

1,250.5

1,219.3

	877.4	2 467 6	2,107.0	739 1		1,205.0	072.0	9/3.0	2,821.2	7 059 4	4.000.4	
į	861.1	21102	1.0.4	722.0	0 100 1	0.002,1	973.R	2000	2,821.2	7 793 4		
	844.4	2.051.5		/04.6	1 205 0	1,200.0	973.8	2 024 2	7.120,2	7,624.8		
	832.9	2,011.2	9 000	037.0	1 205 0		973.8	28212	71,751	7,509.3		
0 000	6.020	1,989.9	6863	5	1,205.0	0720	3/3.8	2,821.2	7 440 2	1,440.3		1, 000
820.4	1 007	0.708,1	679.4	1 205 7	0.002,1	977 A	0.00	2,821.2	7 382 4	1,006.7		15 010 2
813.4	1 042 2	275.7	0/7.1	1 205 0	1,500.0	973.8	2 024 2	7.170,2	7.311.3			15 739 1
804.2	1 909 2	662.3	002.3	1,205.0	0 010	9/3.8	28212	7 7 7 7	7,216.6			15,592.3
780.2	1,824.3	637.0		1,205.0	0720	0.075	2,821.2	6 0770 8	0,372.8		45 24 4 5	13,214.3
755.7	1,739.1	611.7	4 200 0	0.002,1	973 A		2,821.2	6 728 1	0,120.1		11 831 5	7,004.0
756.4	1,742.0	612.5	1 205 0	0.002.	973.8	200	7,128,2	6 736 5			14 847 4	

5,592.3 15,739.1 15,849.3 15,951.4 16,046.1 16,225.2 16,486.7 16,742.5	5,561.2 15,727.0 15,840.2 15,943.0 16,038.3 16,210.5 16,465.2 16,721.5	1,281.6 1,293.6 1,302.7 1,311.1 1,318.9 1,333.6 1,355.1 1,376.1	31.1 12.1 9.1 8.4 7.8 14.7 21.5 21.0
15,951	15,943.0	1,311.1	8.4
15,849.3	15,840.2	1,302.7	9.1
	15,727.0	1,293.6	12.1
15,592.3	15,561.2	1,281.6	31.1
13,214.3	15,183.1	1,250.5	31.2
-	4,835.6	1,219.3	
7 267 4 44 505 5	- 1 - 100'	1,220.3	- 1.600.7
ַ רַ	<u> </u>		

15,849.3

15,739.1

15,592.3

TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

# Financial analysis and Contro

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Uzbekistan Rallways

Financial Analysis (Table 12)

**Fixed Assets** 

At cost start of year Completed W.I.P. Investment (\$184.5million × 110 soum to \$1)

Disposals

Year end (Balance Sheet)

Uzbekistan Railways

Financial Analysis (Table 13)

Depreciation

1998

1997

At start of year Disposals Charge for year (8.6%) Year end (Balance Sheet)

Uzbekistan Railways

Financial Analysis (Table 14)

Work in Progress

At start of year Expenditure for year Completed in year Year end (Balance Sheet)

	2007		2,000,000,0	39 204 0	02,201.0							39,204.0
	2006	000000	3,000,000	39 204 0	21.22						0,00	39,204.0
	2002	000000	0,000,000	39 204 0							35 189 0 35 204 0 39 204 0	39,204.0
	2004	000 000 8	2,000,000	39,204.0							20 204 0	03,204.0
0000	2003	S 000 000	200,000	39,204.0							30 204 0	03,504.0
2000	2002	8,000,000	0.00	32,189.0			4,070.0   4,015.0				39 204 0	0.1204.00
2004	5001	S,000,000 S,000,000 S,000,000 S,000,000 S,000,000	24 440 0	0.611.10							35 189 0	
0000		000'000's 000'000's		0.666,12		0 000	3,520.0		-		31,119,0	
1999	20000	000,000,8	24 189 n	2.00.0		0 077 0	3,410.0				27,599.0	
1998	000	3,000,000 S,000,000.s	18 909 0	2000		0 000 2	0,002,0				18,909.0   24,189.0	
1997	000 000	3,000,000	12,884 0		0.020,0						18,909.0	

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9662 8,000,000 9,297.8 10,097.4 736.3 8,561.5 9.297.8 7,883.6 678.0 8,561.5 624.3 7,883.6 7,259.3 6,684.4 574.9 7,259.3 529.3 6,684.4 6,155.1 487.4 5,667.6 6,155.1 448.8 5,667.6 5,218.8 S,000,000 S,000,000 S,000,000 413.3 5,218.8 4,805.6 380.6 4,805.6 4,425.0 4,073.0 352.0 4,425.0

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		,000						_	
	3000	2007							
	2005					İ			
	2004								
	2003								
	2002								
, 000	592								
0000	2000								
1000	1333								
1008									_
1997		8,000,000	6 025 0		60250			_	

CHAPTER 6 - ANNEXES

# Financial analysis and Control

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Uzbekistan Railways

Financial Analysis (Table 15)

Depreciation on Replacement basis

Locomotives

Mainline diesil Mainline electric Shunting

Passenger cars Freight wagons

Lifting

Track (including signalling)

Soum at mid exchange rate of 110

At book value

Provision for replacement of assets Astronaulated replacement Reserve

	2007	2,000,000													8.021.2		700 6	0.50	7 2216	82 209 2	,,,,,,,
	2006	+-													8,021.2		736.3		7.2849	74.987.6	T
	S 000 000														8,021.2		6780		7,343.3	67,7026	
7007	S ₀₀ (														8,021.2		624.3		7,396 9	60,359.4	
2003	8,000,000														8,021.2		5749		7,446.4	52,962.4	
2002	2,000,000													0	2,120,8		529.3	,	7,4919	45,516.0	
2001	S,000,000													0 004 0	2.120,0		487.4	7 533 0	7,033.8	38,024.1	
2000	s,000,000													8 021 2	2,020	000	4488	7577	10000	30,490 3	
1999	S,000,000													8 021 2		443.3	4100	7 608 0	22 017 0	6.116.22	
1998	S,000,000													8,0212		380.6	0000	7 640 7	15 309 9	222	
1997	S,000,000	Charge	9 120 000	2 160 000	8 534 000	933 333	9,707,000	490 000	2	41 976 000	222	72 920 333	72.92	8,0212		352.0		7,669 2			
	Expected	a a	25	25	25	30	40	10		50											
	Price p u	S SN	1,500,000	2,000,000	850,000	000'02	40,000	350,000	per km	300,000											
	Required		152	27	251	400	707.6	14	km	966'9											
	Current		481	84	313	1,454	32,530	14	ĸ	966'9											

# TRACECA - Central Asian Railways Restructuring Module B: Uzbekistan

# Financial analysis and Control

2007

2006

2005

Projected 2004

2003

2002

2001

2000

1999

1998

Uzbekistan Railways

Financial Analysis

Table16: Loans Disbursement Schedule for Capital Investment Plan (UTY)

Loan Account (in millions US\$)

Disbursed Undisbursed Repayment of Principal Principal owing

Interest (4%)

In soum (000,000) Exchange rate (US\$/soum) Loan Disbursement (millions of soum)
Principle Owing (millions of soum)
Loan Principal Repayment
Interest

		•	18.5	923	,	4.2		40	20.00		c	2	0,140	2.030	467
	•		18.5	110.7	20	2.0		110 00			0	12 177	_	2,030	548
		, (0	18.5	129.2	5.7	;		110.00	00.01		<del>-</del>	14 207	17,507	2,030	629
	,	10 5	0.0	147.6	5.9			110.00	2		0	16 236	2012	2,030	649
		18 5	20.0	166.1	9.9		•	110.00			0	18 266		2,030	731
36.5			. , . ,	184.5	7.4			110.00		2,0,	4,015	20.295	(	ר	812
37.0	36.5	,	0 077	148.0	5.9			110.00		040	4,070	16,280		5	651
32.0	73.5		4410	0	4.4			110.00		2 520	3,320	12,210	c	2	488
31.0	105.5		70.07	0.67	3.2	-		110.00		3.410	7,	8,690	_	0	348
48.0	136.5	•	48.0	2.5	1.9			110.00		5 280	2,200	5,280	c	,	7117



### Annex 5

# Uzbekistan Railway Restructuring

# **Financial Projections**

- A. Income Statement
- 1. Freight Traffic & Tariffs

# 1.1 Freight Traffic Projections

The growth in tariff tonne kilometres is consistent with the optimistic projections contained in the Operations and Traffic Analysis section of this document. A summary of the growth rates in shown in the table below.

# **Growth in Tariff Tonne Kilometres**

Commodity	Growth rate 1997/2000	Growth rate 2000/2007
Stone Coal	108%	-10%
Coke	63%	0%
Petroleum	14%	14%
Ores	6%	7%
Black Metals	2%	2%
Timber	6%	16%
Construction Materials	4%	15%
Fertilisers	27%	41%
Grain	3%	63%
Cotton	5%	
Other	-1%	<del>-7%</del> 0%

# 1.2 Freight Tariffs

It is believed that UTY could implement tariff increases to generate additional revenue and consequently the freight revenue projections include a 20% increase in tariffs in 1999 and a 10% increase in 2000.

Taking note of the difficulty experienced by UTY in collecting its debts it is believed that for any tariff increase to yield benefits then it would have to be reinforced by a policy of prepayment, or at least the right to refuse carriage to customers whose accounts are long overdue.

# 1.3 Freight Revenue

Freight revenue is projected to grow from a base of 13,913 million soums in 1996 to 20,051 million soums in 2000 and to 23,279 million soums in 2007. The growth in revenue is due to the increases in traffic volume set out in the table above and the increase in tariff rates in 1999 and 2000.



# 2. Passenger Traffic & Tariffs

### 2.1 Passenger Traffic

It has been assumed in the financial projections that there will be no growth in the volume of passenger carried during the period cover by the current forecasts.

# 2.2 Passenger Tariffs

An average tariff per passenger kilometre of .686 soums has been used as the basis of calculating passenger revenue for the entire period of the forecast.

# 2.3 Passenger Revenue

Passenger revenue of 1,392 million soums remains constant for the period of the forecast as there is no assumed growth in traffic and no assumed increase in tariff per tonne kilometre.

### 3. Other Revenue

The category of other revenue is made up a number of revenue streams from diverse activities. Included in this category are revenue from Industrial Sales, Passenger Station Services, Loading Services, Passenger Train Services, Freight Forwarding, Other Services, Capital Repairs, and Distribution Services. The financial accounts prepared by UTY contain substantial amounts of "internal revenue" i.e. revenue that has been generated within the railway rather than as a result of trading externally. This revenue has been eliminated from the reported results in order to present a more realistic assessment of the actual revenue earned by UTY.

Other revenue for 1997, after adjustment, was forecast to be 4,813 million soums and this was projected to decline to 4,332 million soum in 1998 and to 3,899 million soum in 1999. Other revenue is projected to stabilise at 3,509 million soum in 2000 and remain at that level for the remainder of the forecast period.

### 4. Expenditure

### 4.1 Payroll

Staff costs have been projected to decline gradually throughout the period of the forecast. This can be achieved through a policy of natural wastage and the implementation of a ban on recruitment. The percentage decline in staff costs in the period 1998 to 2001 has been assumed to be 3% and from 2002 to 2007 it is assumed to be 2%.

Payroll costs, inclusive of social insurance, have been projected to decline from a base of 2,140 million soum in 1996 to 1,920 million soum by 2000 and to 1,650 million soum by 2007.



### 4.2 Materials

Materials costs have been projected to rise from a base of 771 million soum in 1996 to 804 million soum in 2000 and to 877 million soum in 2007. All material cost increases relate to changes in the volume of freight activity (i.e. Tonne Kilometres transported) and the four areas where the increases are evident are Freight & Commercial Operations, Freight Traffic Operations, Freight Locomotives, and Freight Wagons.

### 4.3 Fuel

Fuel Costs have been projected to rise from 1,791 million soum in 1996 to 1,909 million soum in 2000 and to 2,168 million soum by the year 2007. All fuel cost increases relate to changes in the volume of freight activity (i.e. Tonne Kilometres transported) and the four areas where the increases are evident are Freight & Commercial Operations, Freight Traffic Operations, Freight Locomotives, and Freight Wagons.

### 4.4 Power

Power Costs have been projected to rise from 627 million soum in 1996 to 662 million soum in 2000 and to 739 million soum in 2007. All power cost increases relate to changes in the volume of freight activity (i.e. Tonne Kilometres transported) and the four areas where the increases are evident are Freight & Commercial Operations, Freight Traffic Operations, Freight Locomotives, and Freight Wagons.

# 4.5 Other Costs

Other costs have been projected to increase from 4,147 million soum in 1996 to 4,301 million soum in 2000 and to 4640 million soum in 2007. The cost increases relate to changes in the volume of freight activity (i.e. Tonne Kilometres transported) and the four areas where the increases are evident are Freight & Commercial Operations, Freight Traffic Operations, Freight Locomotives, and Freight Wagons.

# 4.6 Administration Costs

Administration cost have been assumed to remain constant at the 1996 level of 974 million soum for the entire period of the forecast.

# 4.7 Maintenance & Repairs

The cost included in the financial projections for the Repair Fund and Depot Repair of Freight Wagons is 2,821 million soum and this has been held constant for the entire period of the projections.



# 4.8 Ancillary Costs

The category of Ancillary costs is made up a number of cost streams from diverse activities. Included in this category are costs of Industrial Sales, Passenger Station Services, Loading Services, Passenger Train Services, Freight Forwarding, Other Services, Capital Repairs, and Distribution Services. The total cost ancillary services increases from 6,878 million soum in 1996 to 7,216 in 2000 and to 7,958 million soum in 2007. Freight related costs increase in line with the change in tonne kilometres hence the increase in the costs of Loading Services, Freight Forwarding, and Distribution Services. Passenger related costs are assumed to vary in line with Passenger Kilometres but the financial forecast assumes no change in this. Expenditure on Industrial Sales, Other Services and Capital Repairs is assumed to remain constant for the period of the forecast.

# 4.9 Depreciation

The depreciation provision contained in the financial forecasts from 1997 onwards reflects the replacement cost of essential operating assets. Details of the replacement cost depreciation calculation are contained in Chapter 6, Annexe 4, Table 15 of the report.

The replacement cost depreciation provision has been held constant at 8,021 million soum for the period of the forecast.

# 4.10 Operating Loss

UTY reported an operating profit of 5,215 million soum in 1996, however in 1997 after provision is made for replacement cost depreciation the financial result is projected to be an operating loss of 4,157 million soum. An operating profit of 624 million soum is projected for 2000 and this increases to 2,971 million soum in 2007 due to the growth in freight revenue and reductions in staff costs.

### 4.11 Other Costs

Other costs of 3,209 million soum in 1996 represented expenditure by UTY on socially necessary services and activities such as housing, education, health services, farms etc. It is believed that UTY should be divesting themselves of these non core activities and transferring responsibility for the provision of these services to other government ministries. The figure of 1,205 million soum included in 1997 forecast results was taken from UTY own forecast of expenditure on provision of these services in 1997. Expenditure in this category is held constant at this level for the remainder of the forecast.

## 4.12 Financial Costs

The figure of 3,378 million soum included in the 1996 accounts is almost entirely due to interest received from other CAR entities in respect of debts owed to UTY. According to the PADECO report these debts have been cleared and therefore only a nominal sum of 100 million soum was retained in the financial forecasts.



# 4.13 Loan Interest

It is assumed that UTY will borrow \$184.5 million US\$ to implement the investment proposals set out in the low investment scenario of this report. It has also been assumed that UTY will have access to funding at moderate interest rates and a rate of 4% has been assumed in the preparation of the projections. Loan disbursement is assumed to commence in 1998 and will match the investment levels set out in the investment proposal. It has also been assumed that repayment of the loan will be over a ten year period commencing in 2003.

# 4.14 Other Operations Profit

The figure of 1,985 million soum reported for 1996 was taken directly from the PADECO report. This revenue item was attributed to penalties and LTFW charges and for the purpose of the UTY forecasts this was held constant.

### 4.15 Taxation

As replacement cost depreciation results in a operating loss being reported by UTY it has been assumed that no income taxes would be payable for the period of the forecast.

# 4.16 Accumulated Profits/Losses

The accumulated loss at the end of 1996 was 1,348 million soum and based on the assumptions made in this financial forecast this rises to 9,473 million soum in 2000, but by 2007 UTY would have a retained profit of 3,073 million soum by 2007. Growth in traffic, increases in freight tariffs and staff reductions all help to offset the impact of the introduction of replacement cost depreciation

# B. Source and Application of Funds

Funds from operations is positive throughout the period of the forecast. The reported operating losses and the additional "period costs" are offset by the profits generated from other operations and the add back of depreciation, which is a non cash item, results in significant amounts of cash being generated.

The financial forecasts include projections in respect of capital expenditure of \$184.5 million dollars spread over the period 1998 to 2002.

It has been assumed that loans will be received to match the proposed investment program.

The outcome in cash terms is a positive cashflow throughout the period of the forecast which results in the accumulation of a very large unused cash balance of 80,092 million soum by the year 2007.

### C. Balance Sheet

The Cash Balance is taken directly from the Source and Application of Funds Statement and it increases throughout the period of the forecast.



The Accounts Receivable balance declines dramatically between 1996 and 1997 as a result of the settlement of outstanding debts by other CAR enterprises. The outstanding receivable balance is assumed to increase in line with the volume of freight revenue generated and the level of tariff increases applied.

The gross value of fixed assets increases in line with the level of investment from 1998 to 2002 and the accumulated depreciation provision reflects the historical depreciation charges only.

The work-in-progress balance is assumed to be zero for the period 1997 to 2007.

The Accounts Payable balance for 1998 of 1,248 million soum is considerably less than the balance at the end of 1997. It has been assumed that UTY will begin to clear its own backlog of outstanding debts once it receives money from its debtors.

The accumulated losses that are generated as a result of the application of replacement cost depreciation are offset by the reserve for the replacement of assets.



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# APPENDIX 1 - UZBEKISTAN RAILWAYS ELECTRIFICATION



# 7. Restructuration - Electrification

# 7.1 Conclusions and Recommendations

Based on our on fields visists, discussions with local executives and data provided mainly by:

- Local staff track Engineering Expert (UTY)
- Electrification Department (UTY)
- Planning & Economic Department (UTY)
- Capital Construction Department (UTY)
- Operating Department (UTY)

the analysis of present, work in progress and forecast electrifications shows that:

# 7.1.1 Concerning the present electrifications

# 7.1.1.1 Conclusions

The conclusions concerning the present electrifications is that the lack of spare parts, a heavy day-to-day maintenance due to obsolete technology and the inaccurate knowledge of global overview regarding the real estate of electrification equipments induces to upgrade present Reliability & Availiability of electrification system to reach usual standards.

### 7.1.1.2 Recommendations

The conclusions concerning the present electrifications isn that:

- An equipments upgrading estimated at 2,500,00 US \$ is necessary to obtain an usual level of operating
- A Maintenance Policy in association with a Maintenance Plan is is recommanded to UTY (Uzbekistan Railways) to keep a good level of Reliability and Availability of electrification equipments.

# 7.1.2 Concerning the electrification work in progress

# 7.1.2.1 Conclusions

Regarding the electrification work in progress the remarks are as follows:

- The use of obsolete technology even if in present situation there is no choice will engage heavy future costs of maintenance and a low level of RAMS
- Cannibalisation of existing and operating equipments is a very short term issue, the effective
  cost is increased and the damaging risk for spare parts is important and it decrease the
  undresses sections reliability.

# 7.1.2.2 Recommendations

So the main recommanded action concerning work in progress is to finish and commission actual started works.

The proposed budget to finalise this action for 1998 to 2000 years according to received informations:

•	Mekhnat Dzhizak	TRACECA 27 M US \$	scheduled UTY 64.28 M US \$
•	Dzhambay Marakand	TRACECA 10 MUS \$	scheduled UTY 10.52 M US \$
•	Tashkent Khodzhikent	no on TRACECA Route	scheduled UTY no communicated

# 7.1.3 Concerning the forecast electrification

### 7.1.3.1 Conclusions

The conclusions are that:

- A necessary profitability calculation with up to date electrification equipments having an usual RAMS, have to be realised
- A validation of this profitability have also to be realised

before starting any electrification works.

### 7.1.3.2 Recommendations

Recommendations regarding the differents forecast track sections electrifications are as follows:

- It is essential for the quotation and the good service quality of operating to use up to date components as well as gas or vacuum circuit breakers and modern transformers.
- On these basis and only these TRACECA quotations in comparison with UTY prices are:

# 7.1.3.2.1 Tashkent Angren

This section is not on TRACECA Route and scheduled UTY quotation have not been communicated

# 7.1.3.2.2 Marakand Navoy Bukhara Shardzhu

For this track sectionTRACECA quotation is about 300 M US \$ and scheduled UTY quotation is 476.5 US \$ calculated with equipments outgoing from CIS.

# 7.1.3.2.3 Marakand Karshi Shardzu

For this track section TRACECA quotation is also about 300 M US \$ and scheduled UTY quotation has not been communicated.

# 7.2 General presentation

# 7.2.1 Methodology

This study is based on site visits and technical discussions with local executives for:

- Electrification & Energy Supply Department
- Capital Construction Department
- Planning and Economic Department

from 29 th October to 11 th November 1997

The aim of the study is to appraise, on the basis of investment, operating and maintenance costs of:

- Present installations in terms of investments and maintenance
- Works in progress in terms of investments and forecast maintenance
- · Forecast electrifications and associated investments

mainly the opportunity and economic rentability or electrification works in progress and secondary forecast electrifications.

### 7.2.2 Conventions

All prices are expressed at least in:

• US Dollars (US\$).

The local currency in Uzbekistan is SOUM.

The exchange rate at 15 th October 1997 is as follows:

- 1 US\$ = 77 SOUM
- 1 SOUM = 0.013 US\$

### 7.2.3 Abreviations

Α	Ampere
AC	Alternative Current
CTC	Centralised Traffic Control
CIS	Commonwealth of Independant States
DC	Direct Current
Hz	Hertz
km	kilometre (1,000 metres)
kV	kilovolt (1,000 Volts)
MIC	Management Information System

MIS Management Information System

mm millimetres

MVA Mega VoltAmpere (10⁶ VA)

MW MegaWatt (10⁶ W)

RAMS Reliability Availability Maintenability Safety



SCADA Supervision Control And Data Acquisition

SOUM Uzbekistan currency

TRACECA Transport Corridor Europe Caucasus Asia

US \$ United States Dollars

USSR Union of Soviet Socialist Republics

UTY Uzbekiston Temer Youlare (Uzbekistan Railways)

V Volt(s)

# 7.3 Existing situation

# 7.3.1 General

The electrification of UTY is implemented according to a general program assigned for 1993-1995 and for the period up to the year 2000 comply with the decree of the cabinet of Ministers signed I. KARIMOV June 23 1995 N° 304 which indicates actual and forecast electrifications at 23th June 1997./11/97).

This program is in accordance with the table below which is the Attachment 1 to the Decree of the Cabinet of Ministers as of 23 June, 1995, No. 304

Stages of Construction and Commissioning of the Central Asian Railways Sections

	Stage & Section	Maintenance Length (km), including double track	Year of beginning and end of construction
I	Khavast-Dzhizak-Marakand, Mekhnat-Dzhizak	360/250	1993-1995
	1 st stage Khavast-Dzhizak	89/0	1992-1993
	2 nd state Mekhnat-Dzhizak	141/120	1993-1994
	3 rd stage Dzhizak-Marakand	130/130	1993-1995
П	Khavast-Kokand	190/190	1993-1996
	1 st stage Khavast-Bekabad	40/40	1993
	2 nd stage Bekabad-Khujent	40/40	1993-1994
	3 rd stage Khujent-Kanibadam	58/58	1994-1995
	4 th stage Kanibadam-Kokand	52/52	1995-1996
Ш	Marakand-Bukhara	309/100	1995-1998
	1 st stage Marakand-Ziadin-Tinchlik-WS138	193/50	1995-1996
	2 nd stage Ziadin-Bukhara	116/50	1997-1998
IV	Marakand-Karshi-Bukhara	297/0	1997-1999
	1 st stage Marakand-Karshi	140/0	1997-1998
	2 nd stage Karshi-Bukhara	157/0	1998-1999

Stages of Construction and Commissioning of the Central Asian Railways Sections (continuation)

	Stage & Section	Maintenance Length (km), including double track	Year of beginning and end of construction
<u> </u>	Tashkent		
	1 st stage Salar-Khojikent	66/0	1993-1994
	2 nd stage Tashkent-Angren	114/0	1994-1995
VI	Urgench-Kungrad-Beineu	635/0	1995-1999
	1 st stage Naimankul-Kungrad	102/0	1995-1996
	2 nd stage Kungrad-Jaslyk	171/0	1996-1997
	3 rd stage Jaslyk-Beineu	236/0	1998-1999
	4 th stage Naimankul-Urgench	126/0	1997-1998
VII	Kokand-Andijan	322/0	1996-2000
	1 st stage Kokand-Altyaryk	51/0	1996-1997
	2 nd stage Altyaryk-Andijan	85/0	1997-1998
	3 rd stage Andijan-Namangan	95/0	1998-1999
	4 th stage Namangan-Kokand	91/0	1999-2000

# 7.3.2 Electrified lines

Present electrified lines (01/11/97) are as follows:

Operational lenght or UTY amounts for	3655.3 km
Electrified lines in 25 kV	588.6 km
Double track section amounts	682.5 km
See Appendix 1	
Maximum axle load is	24 Ton
Maximum gradient	25 / 1000
Design speed of passenger train	100 km/h
Design speed of freight trains	80 km/h

# 7.3.3 Substations

# See Appendix No 1

There are 8 traction substations:

DILGA

Between Chengeldi and Darbaza stations

SHUMILOVO

North of Tashkent

DALAGUZAR

West of Tashkent

OKOLTIN

South of Mekhnat

YANGIER

North of Khavast

BEKABAD

At Bekabad

VARBDOR

Between Khavast and Dzihizak

BOBOUR

Betwen Dzihizak and Dzhamba?

Each substation consists of 2 transformers of 30/40 MVA and is feeded by National Grid (Energy/Power Minister) in 220 or 110 kVolts.

# 7.3.4 Present technology

### 7.3.4.1 Catenary

Based on the range previously used in USSR it is a 1.25 kV range.

Main data are as follows:

Contact wire

copper

 $100 \text{ mm}^2 \text{ or } 85 \text{ mm}^2$ 

Messenger/Catenary wire steel or steel/copper

 $70 \text{ mm}^2$ 

- Concrete poles
- Porcelain insulators
- Tensionning devices

(1/4)

# 7.3.4.2 Substations

Main technical specifications of energy equipment used in traction substation are as follows:

- Traction transformers Type TDTNJ 25.000 V-40.0000 V/ 110-220 kV
- $\bullet~$  Transformer for electric supply and of line facilities Type TMJ or TNJ 27.5 kV / 400 V
- $\bullet~$  Transformers for electric supply for devices of Automatic Blocking System Type 10 kV / 400 V or 27.5 kV / 230 V
- Measuring transformers Type 110 220 kV, 27,5 35 kV and 10 kV
- Circuit breakers, switches and isolators (separators) Type 110 220 kV, 35 kV and 10 kV

• All the equipment for management including automatic system, telemetrics, communication and operational circuits of alternative and direct current and their sources of power.

# 7.3.4.3 Remarks on present technologies

These technologies for catenary and power supply are 60's technologies based on USSR ranges, even if they were simple and robust, they grow old very fast for the oldest ones (commissioned in 72 year for the odest one) and will soon reach for some components the end of their life cycle, they need a heavy day-to-day maintenance and spare parts coming from Russia, Ukraine and Byelorussia are lacking.

# 7.3.5 Present maintenance practises

### 7.3.5.1 Catenary line

# 7.3.5.1.1 Catenary personnel

Catenary maintenance is performed and shared out by Electricity Department Supply Subsections which are as follows:

TEAM LOCATION	NAME	CATENARY TEAM
TASHKENT	ED 1	YES
KHAVAST	ED 2	YES
KOKEND	ED 3	NO?
BUKHARA	ED 4	NO?
KARSHI	ED 5	NO?
SAMARKHAND	ED 8	YES?
TERMEZ	ED 7	NO?
KUNGRAD	ED 10	NO

Lacking numbers are teams in Turkmenistan or Tadjikistan after USSR dissolution.

On the electrified lines within the electricity supplementies they have Divisions entities for Catenary Maintenance, these gangs are located:

Tashkent including 5 men

Khavast including 6 men

Samarkand including 2 men

They are responsible for catenary preventive maintenance and they perform maintenance works.



# 7.3.5.1.2 Catenary systematic preventive maintenance

A routine prevention works plan named PPR is scheduling preventive maintenance which is based on the following operations:

### 7.3.5.1.2.1 Every 1 week

Regarding PPR once a week, a team including 5/6 men visually control the good safety operating of the catenary and its components as well as section insulators, cables, wires, cantilevers, insulators, fittings and poles.

## 7.3.5.1.2.2 Every 3 months

Testing of catenary is performed by a team of 7 men using a specialized plant (There are two in UTY, named SVIKS and contructed in 1960 and 1970).

1970's specialized plant has been refurbished with computerised measures of main catenary data as well as contact wire height or staggering.

# 7.3.5.1.3 Switch devices maintenance

On main tracks and at branchings catenary is equipped with switches devices remote controlled by the energy dispatcher.

In stations or marshalling yards catenary switching devices are remote controlled from stations on the order of the energy dispatcher.

# 7.3.5.1.4 Contact wire wear

On new line the first examination is of contact wire wear is held after 6 years of operation and then once two years by using a special instrument (micrometer).

Data are input into a log book for analyzing and finding the critical wear out sections and then study the reasons of defaults and undertake necessary measures to decrease the intensive wearout.

# 7.3.5.1.5 Division's chief catenary patrolling

Chiefs of Catenary Regional Divisions visually examine the line each 3 months

# 7.3.5.1.6 No scheduled examinations

Before extreme forecast meteorologic conditions an extra examination is realised every week to detect potential break downs.

# 7.3.5.1.7 Replacement of catenary poles

Catenary poles are in reinforced and centrifuged concrete, CC Type.



Forecast life duration is about 40 years they stand 25 years with no damage, actual supplier is Russia but they are planned tio be be manufactured in Tashkent.

For replacing poles, after a mechanical accident for instance, a track motor car named ADM 1 with a 3 Tons crane is used.

# 7.3.5.2 Substations maintenance

# 7.3.5.2.1 Maintenance personnel

The maintenance works are performed, on field, by permanent team of 4 people.

And for repairing the substations equipments, there is a workshop with actual 15-20 people (Designed staff 30-35 people).

I suppose that this team has also in charge transformers and switching devices other than traction power.

# 7.3.5.2.2 Maintenance operation

Main Maintenance operarations on substations is a day-to-day maintenance, concerning mainly:

- Oil circuit-breakers
- Oil swithes
- And remote control
- Transformers

due to obsolete material technology.

# 7.3.5.3 Remarks on present maintenance

# 7.3.5.3.1 Catenary

Present maintenance is obviously based on examination because installation are recent, less than ten (10) years.

In a few time present maintenance have to be completed by:

- Inspection in a first time
- Technical Verifications in a second time.

During the visit of a Neutral Section near Dalagusar (Tashkent West chord) it is established that many materials have:

- To be changed as well as insulators (vandalism breaking)
- To be heavy maintained with exchanging spare parts as well as tensionning devices

So that actual maintenance is unable to ensure a good RAMS (Reliability, Availability, Maintenability & Safety) of the system by lack of spare parts and lack of outstanding tools concerning the following up of equipments.

### 7.3.5.3.2 *Power supply*

After visiting Dalaguzar substation it is established that installations are correctly maintained but obviously, substations maintenance is very heavy day-to-day maintenance because of material obsolescence technology and the lack of spare parts coming ICS, mainly for:

- Oil circuit breakers and switches
- Impedance catenary protection

And as well as Catenary maintenance, Substations maintenance is unable to ensure a good RAMS (Reliability, Availability, Maintenability & Safety) of the system by lack of spare parts and lack of outstanding tools concerning the following up of equipments.

### 7.3.6 Maintenance costs

# 7.3.6.1 Catenary manpower maintenance ratio and cost

Given by UTY the ratio is as follows:

• 0.5 man per year. for 1 km of catenary needs

For 656 km of linear catenary the yearly maintenance cost is 25*10 ⁶ SOUMS = 25 M SOUMS

• i.e. per km  $25*10^6$  SOUMS / 656 km = 38 109 SOUM/km  $\approx$  494 US\$/km

# 7.3.6.2 Substation maintenance ratio and cost

If it is only taken in account only the 4 people permanent team the ratio is as follows:

• 4 people for 8 substations gives 0.5 man / year / 1 substation.

If it is taken in account also the 15-20 workshop people the ratio is as follows:

• 20 people for 8 substations gives 2.5 men / year / 1 substation.

No information available on substations maintenance cost is provided by UTY.

# 7.3.6.3 Remarks on present maintenance ratio and costs

Ratio of catenary maintenance is very important, it is about 5 times more than in usual european standards, nevertheless the catenary maintenance cost is very cheap about 1/5 of usual prices.

Ratio of substation maintenance could be very important taking in account the workshop team about 4 times more than usual european standards but in lack of costs the balance can't be done.

### 7.3.7 Professional qualifications

### 7.3.7.1 Present professional qualification

The different professional qualifications and training of personnel are as follows:

- Senior Electomechanic
- Electromechanic
- Worker on catenary line

### 7.3.7.2 Remarks on present professional qualification

No remarks, it is a standard professional qualification.

### 7.3.8 Energy costs

### 7.3.8.1 Electricity

Actual price for electric traction power is: 2 SOUM per kW*hour  $\approx 0.026$  US\$ / kWh(07/11/97).

#### 7.3.8.2 Diesel

Actual price for diesel traction power is: 15,820 SOUM per Ton ≈ 205 US\$ / Ton. (07/11/97

### 7.3.8.3 Remarks on energy costs

### 7.3.8.3.1 Electricity

0.026 US\$ / kWh is a very cheap cost, about 4 times less than usual costs about 0.1 US\$ /kWh

### 7.3.8.3.2 Diesel

205 US\$ / Ton is an usual cost

### 7.4 Work in progress

In accordance with Cabinet of Ministers Decree  $N^{\circ}$  304 present work in progress concerns the two following double track sections:

Mekhnat

Dzhizak

Item N° I

120 km double track

Dzhizak

Marakhand

Item N° I

130 km double track

### 7.4.1 Building works organization

Present building organisation for electrification works is represented below:



### 7.4.2 Building works by sections

The Data on the balance of works on progress reports of works is as follows at 01/08/97:

#### 7.4.2.1 Mekhnat ⇒ Dzhizak

On Mekhnat Dzhizak Section, 120 km double track section, the investment scheduled budget for works in progress is as follows:

MEKHNAT ⇒ DZHIZAK 240 km	M SOUM / M USS	By year in M SOUM		
		1998	1999	2000
TOTAL in M SOUM/M USS	4950 / 64.28	1590	2190	1170
Signalling	169 / 2.19	69	100	0
Telecommunications	570 / 7.40	200	340	30
Catenary and substations	3690 / 47.92	1000	1550	1140
Others	500 / 6.45			

### 7.4.2.2 Dzhizak ⇒ Marakhand

Data on the balance of works on progress reports of works is as follows at 01/08/97:

ITEM	ESTIMATED COST M SOUM / M US\$	COMMISSIONED
1. UZBEKTRANSSTROY	55,703 / 723	36,919
1.1. Preparation of soils	1,410	1,152
1.2. Earth works	2,232	883
1.3. Structure construction facilities	1,350	788
1.4. Track works	9,284	5,145
1.5. Automatic Block System	7,130	5,560
1.6. Buildings & Installations	6,920	2,605
1.7. Energy facilities	2,2217	1,9983
1.8. Water supply & drainage	5,160	<b>7</b> 97
2. MINISTERY OF ENERGY	6,697 / 87	3,245
3. MINISTERY OF COMMUNICATION	2,595 / 34	3,245
TOTAL	64,995 / 844	42,753

### 7.4.2.3 Dzhambay ⇒ Marakand

On Dzhambay Marakand Section, 32 km double track section, the investment scheduled budget for works in progress is as follows:

DZHAMBAY ⇒ MARAKAND 64 km ≈ Single track	M SOUM / M US\$	Ву	y year in M SOUM	IM
	1	1998	1999	2000
TOTAL in M SOUM/M USS	810.7 / 10.52	810.7	0	0
Signalling	207.1 / 2.62	207.1	0	0
Telecommunications	99.9 / 1.3	99.9	0	0
Catenary and substations	359.7 / 4.67	359.7	0	0
Others	150 / 1.95	150	0	0

#### 7.4.3 Cost assesments

### 7.4.3.1 Catenary

The estimated cost of electrification account for one (1) km of catenary given by UTY is:

#### ≈ 50 M SOUM ≈ 650,000 US\$

This price includes:

- Cost of catenary itself
- Cost of wires (2) for feeding blocking system and signalling
- Cost of eathing line
- Cost of cables for lighting stations
- Cost of sectionning and parallel posts

#### 7.4.3.2 Substations

The estimated cost of traction substation construction given by UTY is as follows:

• Primary voltage 220 kV

85 M SOUM ≈ 1,104,000 US\$

• Primary voltage 110 kV

 $65 \text{ M SOUM} \approx 845,000 \text{ US}$ 

### 7.4.4 Remarks on catenary and substation work in progress prices

### 7.4.4.1 Catenary prices

### 7.4.4.1.1 Mekhnat - Dzhizak

Regarding § 4.2.1 MEKHNAT - DZHIZAK, 240 km single track equivalent, unit price per km of catenary including substations is:

 $47.92 \text{ M US} / 240 \text{ km} \approx 0.2 \text{ M US} / \text{ km}$ 

This price is expensive but it is in the International range of price for catenary and substation in 25 kV.

#### 7.4.4.1.2 Dzambai - Marakand

Regarding § 4.2.3 DZAMBAI - MARAKAND, 64 km single track equivalent, unit price per km of catenary including substation:

4.67 M US\$ / 64 km ≈0.073 M US\$ / km

This price is very low and it rather corresponds with a price of very rustic built catenary and not including substations.

#### 7.4.4.1.3 Uty catenary prices

Regarding § 4.3.1 Catenary Cost assessment the unit price (per km) of catenary given by UTY not including substations is:

650,000 US\$ / km

This price is *prohibitive* and it corresponds at the price of *most expensive* catenary as well as *High Speed Railways multiplied by 3.5*.



#### 7.4.4.2 Substation prices

The price of traction substation construction:

• Primary voltage 220 kV ≈ 1,100,000 US\$

• Primary voltage 110 kV ≈ 845,000 US\$

is a middle price in the International range of price regarding the old technology used as well as oil circuit-breakers and switches and old remote control, it doe's not include High Voltage feeding coming from National Grid.

#### 7.5 Forecast electrifications

### 7.5.1 Description

See Chapter 7.3.1. Decree N° 304 Items N° III & V and Appendix 1.

### 7.5.2 Uty's cost assesments

#### 7.5.2.1 Marakand - Navoi - Bukhara, 309 km

Electrification is scheduled for 2000 - 2005 years, investment scheduled budget is as follows:

MARAKAND - NAVOI - BUKHARA - 309 km	M SOUM	M US\$
TOTAL	36,688	476.5
Signalling	1218,78	15.8
Telecommunications	6500	84.4
Catenary and substations	13,155.78	170.8
Others	15,813.44	205.4

### 7.5.2.2 Tashkent - Angren, 114 km

Electrification is also scheduled for 2000 - 2005 years, investment scheduled budget is as follows:

TASHKENT - ANGREN - 114 km	M SOUM	M USS
TOTAL	5535	71.9
Signalling	323	4.2
Telecommunications	665	8.6
Catenary and substations	3502	45.5
Others	1045	13.6

#### 7.5.2.3 Bekabad - Kodjent

Tracks and land are on the territory of Tadzhikistan Republic and no answer was given from Uzbekistan Railways.



### 7.5.3 Remarks on catenary and substation forecast electrifications prices

#### 7.5.3.1 Marakand - Navoi - Bukhara

For this section of about 310 km single track equivalent the unit price (per km) for catenary and substations is:

 $170.8 \text{ M US} / 310 \text{ km} \approx 0.55 \text{ MUS} / \text{ km}$ 

Same remark as § 4.4.1.3 "This price is *prohibitive* and it corresponds at the price of *most* expensive catenary & substations as well as High Speed Railways multiplied by 3"

### 7.5.3.2 Tashkent - Angren

For this section of about 114 km single track equivalent the unit price (per km) for catenary and substations is:

 $45.5 \text{ M US} / 114 \text{ km} \approx 0.4 \text{ MUS} / \text{ km}$ 

Also same remark as § 4.4.1.3 and 5.3.1 "This price is *prohibitive* and it corresponds at the price of *most expensive* catenary & substations as well as *High Speed Railways multiplied by 2*" Excepted that prices above are very expensive they are not *consistent* because they have bretween them a ratio of 137 %.

#### 7.5.3.3 Bekabad - Kodjent

No data, no remarks.

#### 7.6 Electrification costs standards

### 7.6.1 Catenary

For one (1) kilometre of 1*25 kV up to 160 km/h catenary for single tracke, including:

- Poles steel or concrete
- Messenger/catenary wire cross section copper equivalent 50 mm²
- Hard drawn copper contact wire ≈ 107 mm²
- Droppers and jumpers
- Earth wire or equivalent
- Tensionning equipment & devices
- Overlaps and isolators
- Sectionning and parallel posts

usual prices are as follows:

### 110,000 US§ per kilometre

This price is based on recent electrifications in Europe: Greece, France, with equivalent ranges of 1*25 kV or 2*25 kV catenaries.

This price is in accordance with usual international confirmed quotations and particulary "Federal Polytechnic school of Lausanne".

#### 7.6.2 Substation

For one 25 kV (or 27.5 kV) traction substation 2*30 or 2*40 kVA feeded by 110 kV or 220 kV High Voltage National Grid including:

- Two transformers with incharge automatic adjuster devices and failure detections
- High voltage circuit breakers, dispatchers and associated devices (tension and current transformers)
- High voltage gantries and bus bars
- 25 kV (or 27.5 kV) circuit breakers, dispatchers and bus bars and associated devices (tension and current transformers)
- 25 kV (or 27.5 kV) high voltage gantries, bus bars and feeder to catenary
- Associated SCADA (Supervision, Control And Data Acquisition) usual prices are as follows:

### 1,700,000 US§ per substation

This price is based on recent electrifications in Europe and partculary on new High Speed Railways with high performance equipments and high level of RAMS (Relability, Availiability, Maintenability and Safety).

This price *does not include* the dedicated High Voltage line coming from the nearest National Grid. post.

An usual quotation for this quotation for this dedicated High Voltage line in 110 kVor 220 kV is about:

#### 175,000 US\$ per km

These prices are also in accordance with usual international confirmed quotations and particulary "Federal Polytechnic school of Lausanne".

#### 7.6.3 Global cost

#### 7.6.3.1 Catenary and sub stations

An average very good cost for 1*25 kV kilometre of single track catenary including substation is about:

#### 175,000 US\$ per kilometre

### 7.6.3.2 Signalling and Telecommunications

The necessary modifications due to the EMC (Electro Magnetic Compatibility) for Signalling and Telecommunication equipments to protect them against 25 kV effects is about:

#### 290,000 US\$ per kilometre of single track



This high price is only applicable when Signalling and Telecommunication equipments have not been contructed with any protection angainst 50 Hz alternative current effects as well as aerial nude telecommunicationand signalling lines on wooden masts.

Generally many Signalling and telecommunication components are already pe-equiped against these effects so that the price above is a maximum maximurum upper limit.

### 7.6.3.3 Electrification clearance

As well as for Signalling and tellecommunications installations structures as wellas:

- Tunnels
- Flyovers
- Bridges

have to be sometimes modified for electrification clearance.

An average *maximum cost* when there are many bridges, tunnels and flyover and *only in that case* could be as follows:

### 500,000 US\$ per kilometre double track or 375,000 US\$ per kilometre single track

For structures the cost of electrfication clearance is generally calculated case by case and depends upon each particular circumstance.

### 7.7 Recognized sections

Electrification costs for works in progress and future electrifications recognized in TRACECA corridor could be resumed by the following tables

### 7.7.1 Mekhnat Dzhizak

This section is constituted by 120 km double track section

ITEM	UTY DATA CAPITAL CONSTRUCTION	PLANNING		RESTATED TRACECA	
	DEPT			For total works	Works let to be realised
	M US \$	M SOUM	M US \$	M US \$	% Total
Signalling	6.5	169	2.19	70	15 %
Telecommunications	2	570	7.40	7	
Catenary and substations	7 for 2 substations	3690	47.92	45	30 %
Others		500	6.45	10 estimated	
To pay	32				
TOTAL		4950	64.28	125	100%

### 7.7.2 Dzhambay Marakand

This section is constituted by 32 km double track section

ITEM	PLAN	DATA NING NOMIC	RESTATED TRACECA	
		DEPARTMENT for 1998 to 2000 year		Works let to be realised
	M SOUM	M US \$	M US \$	% Total
Signalling	207.1	2.62	18.5	
Telecommunications	99.9	1.3	1	
Catenary and substations	359.7	4.67	11.2	55 %
Others	150	1.95	2.5 estimated	33 70
TOTAL	810.7	10.52	32.2	100 %

### 7.7.3 Marakand navoy Bukhara Shardzhu

This section is constituted by 309 km single track section

ITEM	UTY DATA PLANNING & ECONOMIC		RESTATED TRACECA	
	i i	DEPARTMENT for 1998 to 2000 year		Works let to be realised
	M SOUM	M US \$	M US \$	% Total
Signalling	1218,78	15.8	90	
Telecommunications	6500	84.4		1
Catenary and substations	13,155.78	170.8	55	%
High Voltage feeding			20	70
Others	15,813.44	205.4	115 estimated	
TOTAL	36,688	476.5	280	100 %

### 7.7.4 Marakand Karshi Bukhara

This section is constituted by about 300 km single track section and the electrification cost quotation is similar to Marakand - Navoy - Bukhara, ie  $\approx$  300 MUS \$.

### 7.8 Electrification priorities

Electrification priorities are in TRACECA corridor and could be resumed as follows:

#### 7.8.1 Mekhnat Dzhizak

In this section constituted by 120 km double track section works are in progress and to be commissioned and operating in electric traction the following works have to be realised:

- Unrolling and commissioning of buried cable signalling/telecommunications
- Finishing works and commissioning signalling control pannels
- Finishing laying metal gantries and unrolling catenary in stations
- Finishing works and commissioning the two substations of Chinaz and Pakhtakor, the third one Idjarskaya is not essential for the electric traction of the line but it will be for a better RAMS of this section to commission it in a nearby future.

### 7.8.2 Dzhambay Marakand

In this section constituted by 32 km double track section works are also in progress and to be commissioned and operating in electric traction the following works have to be realised:

- Finishing works and commissioning signalling and telecommunications equipments
- Finishing erecting poles on open line, metal gantries in stations and unrolling catenary
- Finishing works and commissioning forecast substations of Smarkhand
- Finishing works and commissioning forecast computerised SCADA

### 7.8.3 Marakand navoy Bukhara Shardzhu

In this section is constituted by 309 km single track section all the electrification works have to be realised.

#### 7.8.4 Marakand Karshi Bukhara

In this section is constituted by about 300 km single track as well as for Marakand - Navoy - Bukhara - Shardzu section all the electrification works have to be realised.

### 7.9 Strategic investment program

The main strategic investment program is to really kick off and commission present works in progress on the recognized sections in the present estate of track alignment.

A previsionnal budget for these works could be as follows:



#### 7.9.1 Mekhnat Dzhizak

ITEM	TRACECA QUOTATION FOR WORKS TO BE REALISED
	M US \$
Signalling	10.5
Telecommunications	
Catenary and substations	13.5
Others	3 estimated
TOTAL	27 M US \$

Not including improvments for track alignments.

### 7.9.2 Dzhambay Marakand

ITEM	TRACECA QUOTATION FOR WORKS TO BE REALISED
	M US S
Signalling	3.5
Telecommunications	
Catenary and substations	5.5
Others	1 estimated
TOTAL	10 M US \$

Not including improvments for track alignments.

### 7.9.3 Marakand Navoy Bukhara Shardzhu

Before involving in new electrification of this section works in progress above have to be entierely finished and correctly commissioned and profitability calculation have to be realised for new electrification with equipments completly compatible with present equipment but outgoing from in a modern range components earning a high level of RAMS and demanding a low maintenance.

In that case and only this one a investment quotation will be about:

300 MUS \$ for fixed equipments

Not including improvments for track alignments.



### 7.9.4 Marakand Karshi Bukhara

Ditto above for fixed equipments investments about.

300 MUS \$ for fixed equipments

Not including improvments for track alignments.

### 7.9.5 Maintenance policy

### 7.9.5.1 Usual standards upgrading

In order to maintain existing equipments in operation without major failures and to make up for the lack of spare parts during the last years the estimated maintenance breakdown budget for fixed present equipments not included track and structures is about:

### 2,500,000 US \$

This amount is based on the value of present operating electrification installations, estimated and the evaluation of the real electrification equipment estate.

### 7.9.5.2 Future maintenance policy

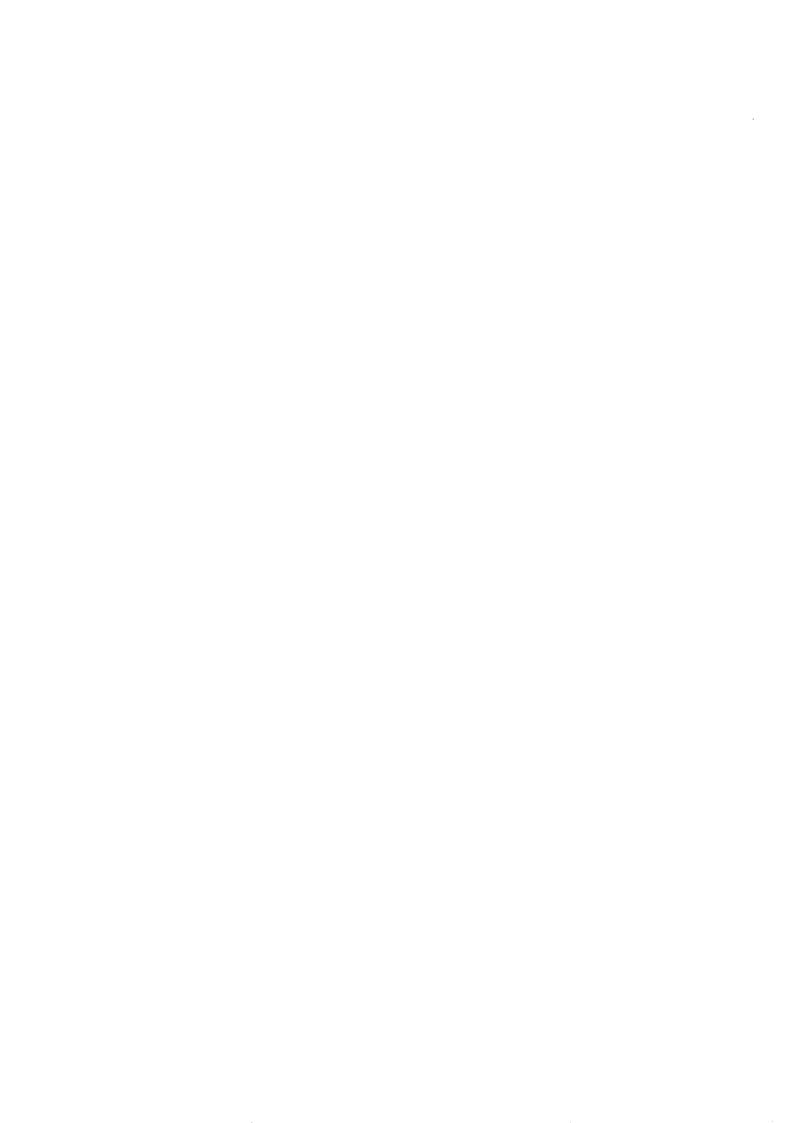
For further years and and new and existing installations a real maintenance policy is necessary in association with a corresponding budget including spare parts supplying.

If this policy is not applied reliability and availability of actual electrification will quickly decrease in a short time and the improvments due to next electrifications will not be significant regarding the investment costs.

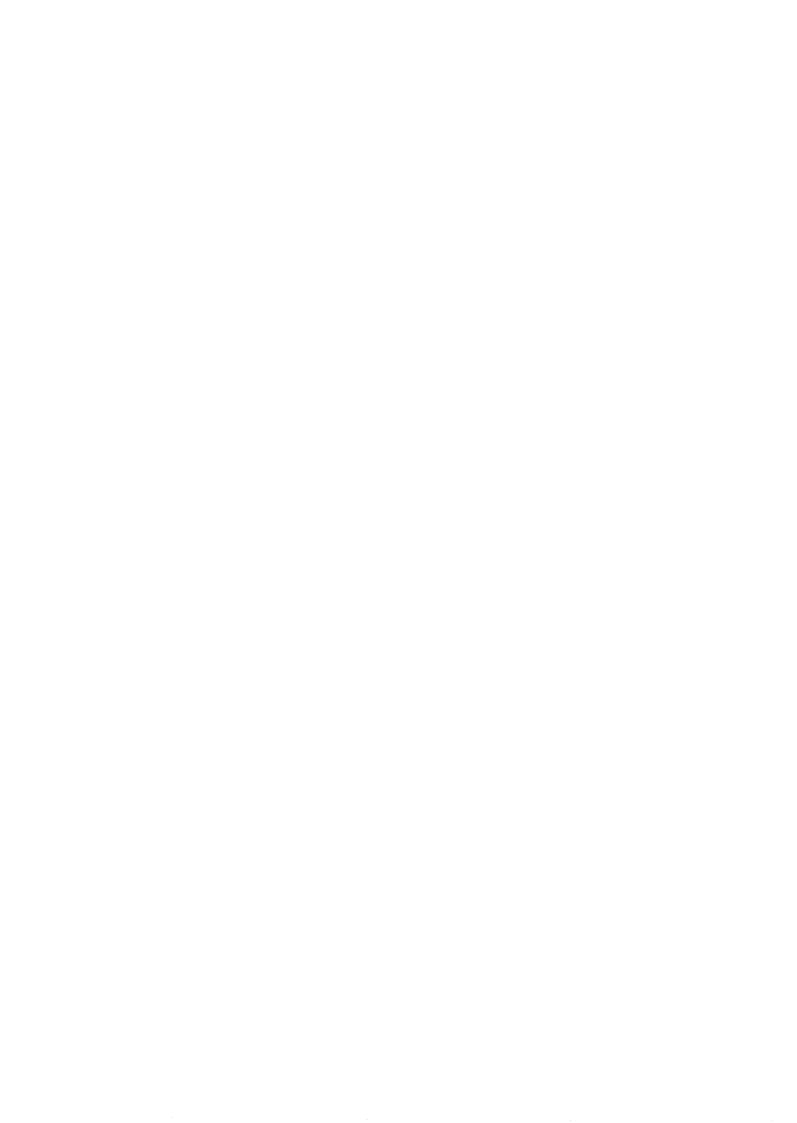
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APPENDIX 1 - UZBEKISTAN RAILWAYS ELECTRIFICATION





### APPENDIX 1 KARASU **YKKURGAN** KHODZHIKENT ANGREN KOKYND TADJIKISTAN KHODIENL **TASHKENT** DUSHANBE CHENGELDI DANGARA MEKHNAT UZBEKISTAN RAILWAYS ELECTRIFICATION BEKYBYD KHAVAST DARBAZA $CHINAZ \cdot$ DZHAMBAY SAMARKAND PAKHTAKOR MI SHAKHRISSABZ IDJARSKAIA *TERMEZ* KUNGRAD SAMARKAND DZHIZAK KAZAKHSTAN SHARDARA GUSAR USHKULACH WARAKAND KARSHI KERKI ΙΟΛΨΝ SHARDZHU TURKMENISTAN UTCHKUDUK uzbelec1.ppt /J.Terny TAKHIATASH $\triangleleft$ KARAPALKIA FLECTRIFICATION IN PROGRESS DT SINGLE TRACK NON ELECTRIFIED SINGLE TRACK ELECTRIFIED DOUBLE TRACK ELECTRIFIED FORECAST ELECTRIFICATION ON WORKS SUBSTATION NVLSHXVZVX



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### Fixed Equipment Maintenance policy and computerisation 8.

#### 8.1 **Conclusions and Recommendations**

### 8.1.1 Computerised tool

The computerised tool could ensure the following operations:

- Fixed equipment inventory
- Maintenance standards with different levels in accordance with the quality of service required
- Triggering scheduled systematic maintenance according to such criteria as: time elapsed, number of switchings for a cut-off device
- Triggering of conditional maintenance operations based on the stepping over a defined level
- Warning of predictive maintenance
- Implementation of maintenance including corrective maintenance
- Inventory of spare parts used and corresponding costs
- Forecast and assignment of the necessary manpower, and corresponding costs

The above field data must be captured as close to the field as possible, i.e. by the Distancia and its crews for the information to be entered on a continuing basis.

The construction and maintenance standards of equipment must also be entered in the system so as to generate a triggering signal for all conditional and predictive maintenance operations; these standards are mentioned under para 1.2.2.

From this system, trend charts with indicators can be drawn up and used at all levels with a fineness degree varying according to the decision level.

### 8.1.2 Maintenance standards

### 8.1.2.1 Standards detected

#### 8.1.2.1.1 Rail wear

Rail replacement is triggered by lateral wear and head height which are usual criteria

#### 8.1.2.1.2 Track geometry

The track geometry is measured using special inspection coaches every 15 days; it is corrected if a threshold is exceeded; there are four thresholds in the standard.

#### 8.1.2.1.3



#### Track renewal

The track and ballast renewal process is triggered after a threshold of 800 M gross tonnes has been exceeded.

### 8.1.2.2 Standards recommended

Working out and using standards is essential to implement a maintenance policy offering a given RAMS (Reliability, Availability, Maintainability, Safety) at a controlled cost.

Standards must be worked out for the following fixed installations:

- · Permanent way
- Civil engineering and earth structures
- Signalling and Telecommunications
- Overhead System and Power Supply

From these standards, a differentiated maintenance policy can be developed.

For instance, the SNCF divided the permanent way into two categories:

- Tracks with a renewal prospect: where the service quality required is high and the maintenance possibilities limited (isolation and possession). Then, long-term maintenance is ensured through track and ballast renewal which, according to standard EN X60-010, can be compared to reconstruction or modernization. This heavy maintenance operation is then triggered according to the real condition of the track and not to a pre-determined time or traffic criterion (X years or X million gross tonnes).
- Tracks without a renewal prospect: where the service quality required is not so high and where there are more maintenance possibilities (isolation and possession). In this case, a « continuous floor » method is applied, consisting in replacing only the sleepers reaching their limit wear (generally, timber sleepers are replaced by concrete ones) and carrying out heavy tamping work only in the areas where this is deemed absolutely necessary.

### 8.2 Control adequacy and conclusions

#### 8.2.1 Controls identified

Maintenance activities are controlled in the way described below:

This control can be cumulated with a traffic and personnel safety control and should not be confused with the technnical control which is a maintenance operation.

#### 8.2.1.1 Inspection of track geometry

This action is performed every 15 days using a special coach belonging to the Management. Weighted rating is then possible resulting in classifying the area into 4 categories. If the area is in a category lower than forecast by the system, the necessary is to be done by the Distancia before the special coach comes next.

8.2.1.2



### Ultrasonic inspection of rails

This is a traditional inspection classifying the rail defects into 4 categories.

### 8.2.1.3 Checking of electric traction installations

These installations are checked every 6 months by the Electrical Engineering Department of the Management, with production of a report, and the necessary corrections are performed following an order of priority.

#### 8.2.1.4 Control of maintenance activities on site

This control is performed at random by a technician of the Technical Department of the Management (one in each discipline) and a report is produced.

According to the Tachkent permanent way Distancia Manager, this «apparatchik» has diagrams and/or sketches.

This is the only overall steering instrument that could be detected during the mission.

### 8.2.1.5 Safety control

Safety controls are performed by a Safety Inspector (from the Trade Association) attached to the Section. These controls do not cover the production aspect of maintenance.

#### 8.2.2 Conclusions

The conclusions drawn from identified controls is that items 2.1.1 to 2.1.3 and 2.1.5 are instant corrective actions. As for the 2.1.4 performed by the Technical Department of the Management, which is the only instrumented one, I could not find out how it was used.

### 8.3 Documents: their contents, circulation and utilization

### 8.3.1 Technical passport for the permanent way

This paper document was made available and analyzed. It contains about 20 pages.

Each page refers to a given installation of the track (switch gear, rails, ballast, fastenings, sleepers, etc...), to level crossings or earth structures or to track maintenance vehicles. Each page shows the initial characteristics and, in certain cases, the evolution of same with time.

Each page contains about 400 boxes to be completed per equipment.

This document is made in two copies by the Distancia (there are 16 for the permanent way specialty in Uzbekistan).

A copy of this document is directly sent by the Distancia to the relevant Technical Department of the UTY Management shunting the Regional Section (Otdelenié); the other copy is kept at the Distancia.



The Technical Department peruses it, incorporates modifications if necessary and returns it directly to the Distancia concerned.

This circuit is annual.

The contents and circuit of this document call for the following remarks:

- this is a document hand-written in two copies the Distancia which is normally a production unit but not of paper!
- this document is totally illegible with small characters and poor formatting
- it is called « Talmud » by its users
- it contains several tens thousand data (400 . 20 . number of items of equipment)
- Who analyzes these data and for what purpose since the document cannot be read and handled

The first conclusions that can be inferred are as follows:

- this is the type of document to be made on computer;
- it should be initialized at the Distancia which must therefore have the necessary means available:
- simplified monitoring elements must be urgently drawn from it for statistical exploitation of unit data which cannot be handled as they are;
- the contents and format must be entirely reviewed;
- its circuit must be associated with and identical to that for the Production and Economic Plan described below:

### 8.3.2 Financial and Production Plan

This paper document was not available but it was described as follows:

- It is a yearly economic and production document prepared by the Distancia which establishes the relations between the Distancia and the Section (Otdelenié). Therefore, it deals with the credits and the associated production of the Distancia for the year concerned.
- Its circuit is as follows:
- ⇒ first step: issue by the Distancia and negotiation with the Section (Otdelenié);
- ⇒ second step: aggregation by the section of all equivalent plans from the other Distancias;
- ⇒ third step: aggregation by the Planning and Economy Department of the UTY Management;
- ⇒ fourth step: negotiation between the Planning/Economy Department and the Technical Departments:
- ⇒ fifth and sixth steps: return to the Section (Otdelenié) and Distancia.



The first conclusions that can be drawn are as follows:

- this document is the master document for maintenance economic steering;
- it must also be made on computer;
- it must be associated with the Technical Passport.

### 8.3.3 Activity report

This report addresses the activities of a crew in a Distancia and is issued by the latter. It contains data on the time spent and the relevant tasks performed. It is a paper document sent by the Distancia to the nearest computer centre where it is entered.

This document is mainly used for the pay.

The first conclusions that can be drawn are as follows:

- this document must be computerized;
- source recording should be at the Distancia or even at the crew level;
- it must be associated with the financing and operational plan and with the technical passport; some data have certainly be entered twice;
- there is such a type of document at the SNCF but simpler and on computer.

### 8.4 Realistic targets for a maintenance policy

### 8.4.1 Different maintenance policy

It is necessary to set up a new maintenance policy based on criteria that can be measured (indicators or ratios) and not on a routine to which are added major overhauls (« Capital Remonte »).

First, service quality objectives must be set, financially estimated and negotiated with the operator at all levels.

The objectives thus set must be accepted at all levels:

- Management
- Section (Otdelenie)
- « Distancia »

Actions to be taken once the service quality criteria have been determined:

- Measure the deviations at all levels using indicators easy to use
- Make all-level actors responsible for their work; the financial interest can be a very good incentive.

#### 8.4.2



### More efficient maintenance policy

The new maintenance policy must be based on the actual service, financial and operating conditions and not on such indications as:

renewal of track and ballast every 800 M gross tonnes for the railway track.

### 8.4.2.1 At the Management level

#### Responsibilities:

- formulating the maintenance policy of the company
- working out maintenance standards in cooperation with the shop floor
- selecting technologies according to the quality/investment and maintenance cost ratio for the lifecycle and not to tradition; changes in technology are:
- ⇒ possible for Running Line but not so much for Turnouts;
- ⇒ possible for Telecommunications;
- ⇒ possible for the Overhead System and Feeder Stations;
- ⇒ more critical for Signalling in an existing environment, but possible for a Control-Centre covered area.

### 8.4.2.2 At the Section (Otdelenie) level

The section formulates the maintenance plan for the General Management to develop its maintenance policy, and liaises with the Distancia.

This section is also responsible for distributing credits and aggregating the various economic and production plans prepared by the Distancias attached to it.

Finally, this section is in charge of:

- preparing and following up the maintenance plan;
- checking implementation on site;
- controlling the safety of personnel and traffic.

### 8.4.2.3 At the Distancia level (depot/shop)

It must be recalled that the Distancia carries out the maintenance operations and that any maintenance policy promoted by the Management is of no use if not accepted by the shop floor.

Therefore, some accompanying measures must be taken such as:

- profit-sharing scheme,
- participation in the preparation of standards and of the maintenance plan



The maintenance policy at this level (Distancia) mainly consists in applying and following up the maintenance plan.

Therefore, the objectives for the Distancia must be identified and set clearly as well as the relevant associated standards for Track, Signalling, Electrification, Telecommunications.

Achievement of objectives go in line with decentralization and making this level aware of its responsibilities..

When visiting the permanent-way Distancia of Tachkent, it was noted that the head of this unit behaved as a real corporate manager.

### 8.4.3 Computer aid

Implementing a new maintenance policy for fixed installations is contingent on:

- a precise definition of the service quality required.
- hence controlled installation damages,
- hence controlled maintenance operations,
- and therefore control of the costs generated by these maintenance operations.

For all these various interlinked parameters to be handled at all levels, efficient tools are necessary.

The principle of such tools is that they are based on many elementary data which cannot be used separately.

The computer tool is the only one capable of meeting the above requirements.



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### 9. Telecommunication and Signalling

#### 9.1 Introduction

The purpose of the mission was to collect data relating to rehabilitation of signalling and telecommunication installations, analysing said data and determining the cost of investments per line section.

The data obtained for the electrification projects on line sections from Mekhnat to Dzhizat (120 km) and from Djambai to Marakan (32 km) mere used to determine the relevant investment costs.

### 9.2 Existing situation of signalling

The Uzbekistan railway network consists of 3655 km lines, 2973 km of single lines and 682 km of double lines.

The whole Uzbekistan network is equipped with a colour light signal block system, track circuits and electric switching points (except for small shunting tracks where they are hand-operated).

The lines and the railway stations are equipped with a Centralised Traffic Control (C.T.C) and all train movements are supervised by the C.T.C located at Tashkent.

The network is divided into 13 sections supervised by 9 dispatchers. Shunting traffic at railway stations is coordinated between the station's operator and the dispatcher. In case of centralised command failure, local operation mode is possible in every railway station.

But in large stations, a single signal box controls all local train movements.

There are three types of central traffic control:

- NEVA technology (5 installed in the mid seventies) using industrial relays to transmit and receive command/control information;
- LUCH (7 installed in the mid eighties) using electronic boards and relays;
- DIALOGUE (1 installed): new computerised system.

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

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



The railway line with automatic block system (stations and open line) are equipped with 50 Hz track circuits. In electrified areas, 25 Hz track circuits are used.

The automatic train control transmits the aspects of the fixed signals to the driver's cab through track circuits which are coded.

For station equipment and block system, the equipment installed before 1978 accounts for 40% of the total equipment installed before 1978 accounts for 40% of the total equipment installed; most of them were installed 30 years ago. Maintaining them in good condition is a real problem.

Stocks of spare parts are not sufficient.

### 9.3 Existing situation of telecommunications

The telecommunication equipment allows the following types of communication:

- central dispatcher to local station operator (dispatching),
- station operators along the line with each other,
- central dispatcher to locomotive drivers,
- shunting personnel to locomotive driver and station operator (radio for shunting operations),
- party lines for permanent way maintenance staff.
- local lines between two railway stations and the telephones at the signals,
- administrative and managing communication for all the staff,
- teleprinter link with other railway networks.

Two types of transmission backbones are used:

- open lines on poles (80%);
- copper buried call (20%).

The whole network offers one telephone line for 2.96 people. It would be possible to increase the number of telephones bearing in mind the capacity of the installations is used today at 90%. It is the lowest rate in Central Asia: 2.8 in Kazakhstan, 2.28 in Turkmenistan and 2.1 in Kyrghystan.

### 9.4 Organisation of signalling and telecommunication maintenance

### 9.4.1 Organisation and workforce

The general railway's headquarters are located at Tashkent.

Signalling and telecommunications are part of the same department. The whole staff amounts to 3290 persons (4% of total railway staff) which means 0.88 person per km of line. This ratio is above Central Asian Standards:

Network	% Staff	N° staff per km
Turkmenistan	8.5%	0.77
Kyrghystan	4.4%	0.58
Kazakhstan	5.4%	0.76

The staff consists of:

- 11% engineers.
- 48% technicians.
- 41% operatives.

There are ten divisions which are in charge of part of the maintenance:

- Tashkent junction,
- Tashkent permanent way,
- Khavask,
- Koland,
- Samarkand
- Boukhara.
- Karchi,
- Termez,
- Ourguentch,
- Koungrad.

Each division has its own central workshop for repairing and a special team for signalling planned maintenance.

The geographical organisation seems adapted.

For training there is a railway technical school at Tashkent which delivers several courses in different specialities: automation, electromechanical, radio, transmission,...

### 9.4.2 Maintenance budget

The operation budget for the signalling and telecommunication department amounts to 473 000 000 CYM per year (7,800,000 USD).

It is broken down as follows:

-	Salaries 170,000,000 CYM	(35.94%)
-	Charges 68,000,000 CYM	(14.38%)
-	Material purchase 24,000,000 CYM	(5.07%)
_	Factory repairs 41,000,000 CYM	(8.67%)
-	Energy expenses 100,000,000 CYM	(21.14%)
-	Structure and others 70,000,000 CYM	(14.8%)

This budget means 2,139 USD per km of line.

It is within slightly higher than other central Asian networks figures when taking into account the level of wages:

Network	Cost per KM (in USD)	
Turkmenistan	1,161	
Kyrghystan	1,418	
Kazakhstan	3,704	

### 9.5 Incidents observed in operation of installation

The number of incidents recorded in 1996 was about 2158; statistics could not be obtained; nevertheless, three reasons can be mentioned for such a high number of incidents causing delays of about 3 hours on an average:

- Unsatisfactory maintenance of installations due to the fact that they have been operating for a long time (30 years old),
- defective equipment or parts due to their degree of wear,
- shortage of spare parts in storage.
- lack of small tools and measurement equipment.

### 9.6 Major problems

Following is a list of factors impeding the satisfactory maintenance of existing installations:

- The shortage of spare parts concerns mainly:
  - switching point motors,
  - safety relay substations manufactured in 1950,
  - power supply equipment batteries in very poor conditions.
- The shortage of resources to commission vehicles, measurement systems and tooling.

  In case of an incident or traffic delay, resources should be made available to ensure the rapid implementation of emergency maintenance measures.

The signalling installations are characterised by their:

- variety of equipment,
- location (track side or in signalling room),
- geographical scattering

Maintenance is twofold: preventive and corrective.

Preventive maintenance includes monitoring and actual maintenance.

Monitoring consists in a visual <u>inspection</u> of the general condition of the equipment and wiring, in <u>checking</u> features, track equipment layout dimensions, set values....and also in basic running tests (point motors...) or a whole system testing (level crossing...)

Actual maintenance consists in rough cleaning or more thorough cleaning after dismounting, lubrication, re-tightening...and also in preventive replacement of items that are worn out or have a limited life contingent on their use (lamps,...).

Corrective maintenance takes place further to failures in operation of installations and consists in analysing the circumstances of the incident, locating the failure and repairing with possible replacement of items if necessary.

The time spent by the maintenance staff in analysing incidents and repairing added to the difficulty of properly monitoring and maintaining the installations (lack of spare parts, small tooling...) result in an insufficient productivity rate.

### 9.7 Measures to be implemented to improve maintenance

In order to ensure the satisfactory maintenance of existing installations along specific rail line sections, or their replacement beyond the year 2005 (see capital investment table), the maintenance unit should be supplied with the following equipment:

- basic spare parts required,
- small equipment,
- tooling,
- devices

In order to also improve the productivity rate of maintenance personnel, the task distribution should be improved. The frequency of monitoring and maintenance operations is based on whether the equipment depends on the traffic or not. According to the knowledge of local installations and their environment, the intervals can be extended or shortened.

Provided the necessary spares, small tooling and instrumentation are available in sufficient quantity, and considering the geographical scattering of the installations, the intervals between maintenance operations must be optimised to get a higher productivity rate. To this end, the real equipment damage criteria must be taken into account while keeping the same safety level.

Two cases are to be envisaged:

- the equipment classified as critical, i.e. liable to wrong-side failures (relays,...),
- the equipment classified as non-critical: all the other items of equipment whose failure may entail incidents of varying seriousness depending on their function.

Equipment damage must also be considered, depending on their reliability, particular conditions of installation, duration, speed and number of daily trains.

The result of these analyses will allow the maintenance executives to draw up maintenance plans better suited to local conditions and to ensure a higher productivity especially by reducing the number of incidents.

# 9.8 Replacement of obsolete installations, costs of investments and degree of priority

### 9.8.1 Introduction

The tables summarise by rail line section, for signalling and telecommunications systems, the type of capital investments required, their amount as well as a priority order to be followed: 1st year, 2nd year, etc.

These amounts do not take into consideration the capital investments to be performed as part of the electrification project of the following rail line sections: Mekhnat - Dzizhak and Djambai - Marakand.

The last table on page 9 highlights the most pressing needs and amounts required to purchase spare parts in order to ensure satisfactory maintenance of the signalling system.

### 9.8.2 Signalling

Signalling investments are shown for three types of installations:

- in stations: replacement of signal boxes and track installations,
- between stations: replacement of automatic block or semi- automatic block installations by equipment based on recent technology,
- for sections : replacement of the Traffic Control Centre equipment.

The total investments needed in short, medium and long terms amount for a total of USD 53,756,000.

These proposals were reviewed in order to give priority to these which:

- · may affect safety,
- may affect significantly the performance of the operation,
- concern the most loaded sections.

These which felt necessary according to the obsolescence of the equipment are left for later investments. Considering the strong traffic reduction which are faced by UTY, some of the investments won't be considered necessary in the short, 1980's traffic not being recovered until long, and capacity limits not being reached.

### 9.8.3 Telecommunication

The modernisation of telecommunication equipment concerns stations and sections. The investments required amount for a total of USD 20,000,000.

For review purposes, these which are concerned by module E won't be taken into account. Thefore most of the proposed investment won't be dealt with, such as modernisation of telecommunication using optic fiber.

The annexed tables show the items of equipment to be replaced per line section:

## 9.9 Electrification of the rail line sections between Mekhnat- Dzizhak (120 km) and Dzanbaï - Marakand (32 km)

The amount of capital investments required for the signalling and telecommunications systems are listed in Chapter 7 - Recognised sections of the Report Electrification.

### 9.10 Capital Investments and priority Order

### 9.10.1 Signalling System

Under the present context, additional spare parts, tools and measurement devices are required for maintenance technicians to be able to work under acceptable conditions.

An additional US\$ 1,000,000 in capital investments is required, as specified in the above table.

Cables, signalling circuits between stations and block sections, station equipment, centralised traffic control systems should be replaced following a specific project schedule. The modernisation project will help decrease the number of incidents and train traffic delays.

The overall amount of capital investment required does not exceed US\$ 53,000,000 as shown in the table "Signalling System Department - Summary of capital investments required". These, as they do not affect significantly, in the short term, the operation of UTY, are proposed to be left for later.

### 9.10.2 Telecommunications system

The table on page 4 specifies the amount of capital investments required, which should take place according to a schedule that remains to be defined.

Rail lines should be equipped with optical cables and digital transmission systems.



## **Telecommunication and Signalling**

We should also consider replacing all existing radio transmission systems.

The overall capital investment required amounts to US\$ 20,000,000. See Table "Telecommunication Department Investments required". These, as they do not affect significantly, in the short term, the operation of UTY, are proposed to be left for later.

### 9.10.3 Telecommunication

The lines should be equipped with optical cables and digital transmission equipment.

#### SIGNALLING SYSTEM DEPARTMENT

Modernisation of signalling systems

### Summary of capital investments required

Priority Year	Amount
1	13,129,750 USD
2	13,030,750 USD
3	12,393,750 USD
4	10,067,750 USD
5	5,134,000 USD
TOTAL	53,756,000 USD

## TELECOMMUNICATIONS SYSTEM DEPARTMENT

Modernisation of telecommunications systems

### Summary of the capital investments required

Priority	Amount
1	10 M. USD
2	3,1 M. USD
3	3 M. USD
4	3,4 M. USD
5	0,5 M.USD
TOTAL	20 M. USD

## **Telecommunication and Signalling**

#### SIGNALLING AND TELECOMMUNICATIONS

## REQUIREMENTS TO ENSURE MAINTENANCE

DESCRIPTION	AMOUNT USD	
Electric Switching	360,000	
Printed circuits	150,000	
Lamps radio	50,000	
Lamps signal	30,000	
Transistors	120,000	
Diodes	20,000	
Resistors	10,000	
Capacitors, various Types	120,000	
Instrumentation	150,000	
Tooling	50,000	
TOTAL	1,000,000	

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#### 10.1 Introduction

The infrastructure expert was in Uzbekistan from 15 to 26 September 1997.

His task consisted in taking a brief stock of the existing installations, analysing their condition and determining the investments necessary for rehabilitating and upgrading the network.

The counterpart of this expert was Mr.Irgashev, professor with the Institute of Railways in Tashkent.

### 10.2 Statistical data on the infrastructure

The main characteristics of the network are shown underneath:

Track	
Single track	2972.8 km
Double track	681.3 km
Triple track	1.2 km
Total route	3655.3 km
Main track	4339.0 km
Auxiliary main track	2171.0 km
Siding	485.6 km
Total track	6995.0km
Max Axie load	
	23t
Gradient	
0 0/00°	698.5 km
< 4 ⁰ / _{00°}	2299.6 km
$4^{0}/_{00} < g < 8^{0}/_{00}$	874.2 km
$8^{0}/_{00} < g < 15^{0}/_{00}$	459.2 km
$15^{0}/_{00} < g < 25^{0}/_{00}$	7.5 km

The network is not entirely on the Uzbek territory: certain lines encroach on neighbouring countries:

- Turkmenistan between Shabat and Takhiatash
- Tadzhikistan between Bekabad and Khodjent
- Kazakhstan between Mekhnat and Dzhizak



#### The track condition

#### 10.3.1 The standard track

The gauge is 1.52 m. and this track is made up of:

• 65kg/m rail on the majority of the track

Rails	
75 kg/m	711 km
65 kg/m	3303 km
50 kg/m	739 km
43 kg/m	290 km
Continuous Welded rail	2654 km

- reinforced concrete sleepers laid with a spacing of 54 cm (1840 per km)
- KB65 fastenings

annex 1

• ballast layer: 30 to 35 cm.

The track is laid to 82% on reinforced concrete sleepers.

UTY plans to replace the existing timber sleepers by reinforced concrete sleepers.

#### 10.3.2 Layout

Most parts of the track is laid straight or in curves > 1200m.

Radius	Length (km)
σc	3075
>1200	202
1001< R < 1200	99
801< R < 1000	70
651< R < 800	- 66
501< R < 650	179
351< R < 500	33
300< R < 350	7

In small radii curves, hard-grade rail is used.

### 10.3.3

#### General condition

On the sites visited, track equipment maintenance was satisfactory (fastenings properly tightened, points lubricated). However, the ballast layer was very poor both in terms of ballast quality (polluted, deteriorated ballast) and of thinness of the layer and, consequently, levelling and lining lacked accuracy.

To-day, there are speed restrictions on 1500 km of track, that is 35% of the network. This figure does not reflect the real state of the track since a number of these speed restrictions are regulatory measures further to delays in the performance of renewal work.

Making the application of these speed restrictions less automatic and more dependent on an examination of the real condition of the track and its components would be advisable.

# 10.3.4 Analysis of speed restrictions on the Chengeldy - Khodzhidavlet section

This is the Uzbek part of the silk route. Length of speed restrictions is shown underneath:

20	ene	igth (in km)	renewal (in km)	lateral wear	other (in km)	total spr (in km)	%
Chengel'dy	Tashkent	156.6	110.6	(in km) 46		156.6	100
Taschkent	Khavast	302.8	270.7	17		287.7	95
Khavast	Dzhizak	89.4	13.9	4		17.9	20
Dzhizak	Marakand	259.6	114.9	10	15.1	140	54
Marakand	st24	25.4	12	3		15	59
st24	Kata Kurgan	68	34.4	12		46.4	68
Kata Kurgan	Navoi	79	26.8	4	48.2	79	100
Navoi	st38	76	34.7	5		39.7	52
st38	st41	44	17.1	4		21.1	48
st41	Khodzidavlat	200	121	5	2	128	64
Mekhnat	Dzhizak	244	136.7	6		142.7	58
Total		1544.8	892.8	116	65.3	1074.1	70
% /total lgth		·	58	8	4	70	7
% /spr lgth			83	11	6		

On this section, as on others, most of the speed restrictions are of regulatory nature since they are imposed as soon as the date planned for track renewal has been overrun.



### The track components

#### 10.4.1 The rails

65 % of the track is made up of rail R65 (65kg/m) which do not pose any specific problem.

62% of the rails are laid as CWR. The length of CWRs is limited to 800m. The expansion device is made up of three 12.5 m lengths on either side of the long rails.

The areas with normal rails are generally made up of 25m lengths.

### 10.4.2 The sleepers

#### 10.4.2.1 Timber sleepers

18% of the tracks are fitted with timber sleepers. UTY plans to replace the existing timber sleepers by reinforced concrete sleepers. Today timber sleepers are imported from Russia. They are made of creosoted pinewood. The theoretical duration of timber sleepers is 15 years. Actually they around 8 years.

Fastenings are secured to timber sleepers by means of spikes. The plugging and re-boring techniques are not used.

### 10.4.2.2 Concrete sleepers

82% of the tracks are fitted with concrete sleepers. These sleepers are made by the factory of Akhangaram belonging to the railways of Uzbekistan. Many quality defects could be noted on these sleepers. Rebars could sometimes be seen at sleeper ends and are placed very near the internal faces. Rebars get quickly corroded and reduce the sleeper duration.

The design and the making process must be reviewed. Modifying the design of the sleeper should imply the use of a simpler and more efficient fastening system (type NABLA, PANDROLL, VOSSLOH...).

#### 10.4.3 The fastenings

On main line, the Russian KB type of fastening is used. It was noted that the seal on the outside bolt was damaged in places (poor quality or insufficient maintenance?).

Due to this lack of tightness, water and foreign materials are found in the recess reserved for the bolt, resulting in:

- corrosion of fastening,
- impaired efficiency of the rail/sleeper assembly.
- poor electrical insulation entailing signalling failures due to defective operation of track circuits.



As the KB system is not an elastic system, it is subjected to very high stresses. Therefore, this system calls for very heavy maintenance work. Alternative solutions will have to be considered. It would be useful to investigate adapting European fastenings (VOSSLOH, Pandrol, NABLA) to this type of sleeper.

#### 10.4.4 The ballast

The ballast is extracted from the 2 Uzbek railway quarries located in Ziadin and Jumurtau. It is made up of crushed stones with 40/60 mm grading.

#### 10.4.5 The switch gear

The inventory of switches is shown as underneath:

Track	1:9	1:11	Total
Main	550	1748	2298
Secondary	1021	1007	2028
Total	1571	2755	4326

### 10.4.6 Glued insulated joint

The bad quality of glued joints causes numerous electrical insulation faults which cause signalling incidents.

The repair of insulation faults entails a big amount of work within maintenance units.

As there is a shortage of supplies, the insulated joints found on the track are frequently produced on site with textile components. This type of joint has a bad mechanical quality and gets quickly damaged.

### Maintenance organisation

### 10.5.1 Types of operations

#### 10.5.1.1 Renewal of track and ballast

Track and ballast renewal is scheduled after the passage of 800 000 000 tonnes which corresponds to 25 years on the most loaded lines. This regulation is adapted for this level of traffic.

The technique used consists in standard replacement of 25 m track panels:

- 1. 25 m panels are assembled at the assembly site of the PMS entrusted with the work and are transported to site by special trains.
- 2. The track to be renewed is cleared.
- 3. The track to be renewed is removed in 12m sections by a 9-tonne capacity Platov crane.
- 4. The panels are transported to the PMS's dismantling site.
- 5. A caterpillar tracked machine skims the remaining ballast.
- 6. The new track is laid by an 18-tonne capacity Platov crane.
- 7. The track is ballasted.
- 8. The track is levelled by a VPO. This machine lifts the rails using magnetic pads, pushes the ballast under the track from the sides and vibrates the track.
- 9. The dummy rails are replaced by continuous welded rails.

For such works, the UTY have the following equipment available:

- 2 cranes on wagons.
- 1 clearing machine
- 1 ballast surface finishing machine
- 1 tamping machine (track vibration: vpo3000)
- self-charging wagons.

The average work rate for this type of work is about 1000m per shift.

Provisional rails are replaced by CWRs of 800 m after passage of 100 000 t.

#### 10.5.1.2 Ballast renewal

A cleaning /renewal operation is initiated when 45% of the ballast in an area is declared contaminated (test on sample).

For these works, UTY have at their disposal:

- I clearing machine
- 1 tamping machine (track vibration: vpo3000)
- self-charging wagons.



10.5.1.3



## Levelling - lining

A heavy mechanical tamping campaign takes place every 5 years.

#### 10.5.1.4 Intermediate maintenance

Between these major operations, the "track distance" gangs carry out small corrective maintenance operations, consisting mainly in the replacement of broken components (rail repairs, replacement of sleepers, maintenance of fastenings.)

### 10.5.1.5 Track inspection

### 10.5.1.5.1 Track geometry

The Uzbek railways have 2 track recording coaches dating back to the 60's.

A measurement campaign takes place each month on main tracks and every 2 months on secondary tracks.

The criteria measured are

- the gauge,
- the longitudinal levelling
- the transverse levelling
- deflections

The recorded values are printed on paper at a rate of 50 cm/km.

### 10.5.1.5.2 Rail defects

The Uzbek railways have 2 coaches for magnetic measurement of rail defects. These measurement campaigns are coupled with track geometry inspection campaigns.

### 10.5.2 The structure

Maintenance of fixed installations is distributed among 16 "track distances" in charge of managing 250 km of track on an average.

In addition, there are 5 "machine stations" in charge of heavy machine operation and of renewal work (assembly, disassembly of track panels...).

The strength of each workshop is about 150 persons.

#### 10.5.3



### The personnel

In total, 8637 persons work in the track maintenance field, 6200 being directly assigned to production.

Therefore, the ratio is 1.23 technicians per kilometre of track or 2 per kilometre of main track. This ratio is within the range of central asian railways.

### 10.5.4 The equipment

Machine	Number	In service
UK 25	13	10
ShOM 4	2	2
BMS	2	2
VPO 3000	8	5

UK25: Platov crane

Used to remove and replace the 25m track panels.

ShOM4 :Clearing machine

BMS: Machine to shape the ballast when the track has been removed.

#### 10.5.4.1 **VPO3000**

Used to level the track.

Vibrates the track without tamping the sleepers.

Progress: 900 to 1200 m/h.

### 10.6 Civil engineering structures

C.E. structures		Number
Bridges		
Concrete	Number	1366
	Length	29702
Composite	Number	21
	Length	2353
Steel	Number	48
	Length	4220
Pipes	Number	3142
	Length	44282

These structures are principally small ones.



### **Drainage-Earth structures**

Certain disturbances due to the instability of the formation were indicated. These incidents lead to temporary speed restrictions on the route:

incidents	length
flowing aside	4.6 km
settling	80.2 km
land slide	1.5 km
mud flows	42.2 km
flooding	240.2 km
total	368.7 km

#### Particular case of the embankment at KP 3650

Between KP 3650 and 3652, the track is laid on a 20 m embankment.

Significant settling of this embankment was noticed, imposing speed restrictions.

This embankment is situated between GallAral and station 16.

Stabilising the embankment is an imperative prerequisite to electrification work.

#### 10.8 Recommendations

#### 10.8.1 Track work

### 10.8.1.1 Track renewal unit cost

#### Cost of equipment over 1 km

	qty	u	pu (\$)	price (\$)
Rail	130	t	750	97 500
Sleepers	1 840	u	30	55 200
Fastenings and pads	1 840	u	30	55 200
Ballast	1 300	m3	3	3 900
Total				211 800

The total cost per km, based on international prices, of renewal is 400 000 US\$ out of which 210 000 US\$ are for the supplies.

For a significant reduction of speed restrictions, the following work sites are priority ones:

from	to	USS
Djambay	Marakand	2 240 000
Chengeldy	Tashkent	18 400 000
Tashkent	Khabast	6 800 000
Djizak	Khabast	2 400 000
Total		29 840 000

Delays in track renewal work automatically entail speed restrictions.

We considered priority n°1 the areas where speed restrictions were 60km/h or below.

## 10.8.2 Work on earth structures

General draining study	250 000 US\$		
Embankment study	250 000 US\$		
Total	500 000 US\$		

## 10.8.3 Civil engineering work

On many concrete bridges, damaged decks or cracks were found.

Additional investigations have to be performed, especially concerning the bridges on Mekhnat-Dzhizak and Djambai-Marakand sections.

These bridges are situated at the following KPs:

Mekhnat-Dzhizak

- 3508+780
- 3557+352

Djambai-Marakand

- 3704+329
- 3704+923
- 3705+561
- 3705+773
- 3741+353
- 3752+980

Two bridges will be repaired.

Action	Study 2 Bridges damage Urgent repairs
Budget	2 000 000 US\$

10.8.4

#### Mechanisation of maintenance

Track maintenance mainly consists in major repairs (total renewal) and intermediate repairs (replacement of part of the track equipment). These operations are performed by the "PMS" and are highly mechanised. Total renewal uses highly suitable machines with an average output of 1000m per period of work.

The lack of materials and the almost continuous mobilisation of the machines for constructing new lines entail delays in these major operations and make the corrective maintenance operations heavier.

In opposition to this high mechanisation of the renewal work, the corrective maintenance work is hardly mechanised. Almost all maintenance operations are manual despite the heavy equipment of the track which makes the least operation very hard and long.

Therefore, we propose to fully mechanise corrective maintenance so as to make it more significant and palliate the delays in major operations thus allowing to maintain the track in a more efficient and less costly way.

Levelling-lining of the track and turnouts and sleeper renewal are the operations most frequently performed by the maintenance units.

#### 10.8.4.1 Tamping machine

The track levelling machines used in Uzbekistan are the VPOs. These machines are mainly used for construction work and major renewal work. The purchase of running line/turnout mixed tamping machines type 08 is recommended.

The output of these tamping machines is about 1000 m per period of work, i.e. 300 km per year approximately. The purchase of 5 tamping machines apt for tamping 1500 km in a year is recommended.

There will be one every two distances (section).

Action	Purchase of 5 type 08 mixed tampers
Budget	8 750 000 U\$

### 10.8.4.2 Equipment for sleeper inserting gang

Sleeper replacement operations are among the most frequent operations. There may be several reasons for replacing sleepers: mechanical (breakage, cracks), substitution of concrete for timber, or insulation faults. These operations are very difficult to perform manually, especially when replacing the very heavy monoblock reinforced concrete sleepers.

Investing in equipment suitable for forming roving sleeper replacement gangs would be advisable. Such gangs would have:

- 2 sleeper replacement machines
- 2 sleeper-screw drivers
- 1 timber-cutting machine
- I mechanical shovel
- 1 small tamping machine (4th level)
- 1 truck (for the supplies)
- 1 van (for the gang)

Action	Purchase of 3 sets of such equipment
Budget	4 500 000 US\$

#### 10.8.4.3 Ballast cleaner

Ballast degradation and pollution due to the presence of sand make it imperative to proceed to crushing and cleaning operations.

	chase of a screening machine
Budget	3 000 000 US\$

## 10.8.4.4 Ballast regulators

Within the scope of a general reballasting of the track and of a re-levelling by heavy mechanised tamping, the purchase of ballast regulators is essential to improve the ballast shape.

Action	Purchase of 3 ballast regulators
Budget	3 000 000 US\$

## 10.8.5 Improvement of material quality

### 10.8.5.1 Sleepers

The poor quality of the sleepers and of the whole fastening/sleeper assembly make it necessary to modify their design and find solutions to improve the fastening system (including the adaptation of a more modern one).

The sleeper factory should be modified.

Action	Investment in the factory	
Budget		2 000 000 US\$

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## Infrastructure

10.8.5.2



#### Glued insulated joints

The poor quality of the materials which constitutes glued insulated joints are the main cause for numerous signalling incidents. It is convenient to purchase around 1100 GIJ to be installed on the Chengeldy-Khavast-Marakand line and the Mekhnat-Djizak line.

Action Supply of materials	
Budget	1 000 000 US\$

#### 10.9 Investments

#### 10.9.1 Total investment

#### Figures are given in USD.

ltem	Cost (US 3)
Track renewal	29 840 000
Earth structure works	2 000 000
Civil engineering works	2 000 000
Improvement of material quality	
Investment in the sleeper factory	2 000 000
Supplies for GIJ	1 000 000
Mechanization of maintenance	
5 tamping machines	8 750 000
3 sets for sleeper installation	4 200 000
l ballast cleaner	3 000 000
3 ballast regulators	2 550 000
TOTAL	55 340 000

#### 10.9.2

## Investment per year

### Figures are given Million USD.

Item	TOTAL	Vest 1	Year 2	Year 3	Year 4	Year 5
A- Improvement of track components						
Track renewal	29.84	15	14.84			
Earth structure work	2.00	2.00		*		
Civil engineering work	2.00	2.00				
Improvement of concrete sleepers factory	2.00	2.00				
Supply of Glued Insulated Joints	1.00	1.00				
B- Mechanisation of the maintenance						
Tamping machine	8.75		3.50	3.50	1.75	
Equipment for a sleepers inserters gang	4.20	1.40	1.40	1.40		
Ballast cleaner	3	1.00	2.00			
Ballast regulators	2.55		0.85	0.85	0.85	
Total	55.34	24.40	22.59	5.75	2.60	



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### 11.1 Executive summary

The aim of this study was to confirm and detail the investment plan for the UR for the 10 next years.

The base was the "TRACECA Rolling Stock Maintenance-Railways" study which indicate the size of the rolling stock fleet and the investment plan associated.

The "PADECO" report indicates a different size of the fleet and accordingly huge different levels of investments.

In conclusion, we have decided to develop our argumentation, based on the TRACECA hypothesis and compare the two plans.

At the end of the study we have analysed the effects of tracks electrification and compared the two modes.

For a general point of view, the UR rolling stock and depots are in good conditions.

Here is a resume of the investment plan we propose

- Buy new electric locomotives
- Buy new tank wagons
- Renew passengers cars
- Renew depots and workshops
- Purchase spaceports

#### 11.2 Introduction

The Uzbekistan Railways was a part of the railway network of the former Soviet Union, and has 3655,7 km.

After the dissolution of the Soviet Union, the railway freight traffic has dropped dramatically from 77 million tonne-km in 1990 to 40 million tonne-km in 1993.

Passenger traffic seems to remain constant at 5.8 million passenger km.

Generally, the core of the maintenance facilities has sufficient capacity and is in an acceptable condition. However, there are needs for modernisation of some maintenance and repair tools and maintenance of the workshop and depot buildings: cleaning, painting, heating, and others.



#### Locomotives

#### 11.3.1 Overview

UZ has a large fleet of both electric and diesel-electric locomotives, all built in the Former Soviet Union.

#### 11.3.1.1 Electric Locomotives

The electric locomotives are reliable in the general sense. With proper level of maintenance, these locomotives should be able to provide many years of reliable service (35 years).

The number of locomotives in service is 81.

The tables below describe type and description of the locomotives fleet.

SERIES	ТҮРЕ	AVERAGE AGE	AXLE ARRANG	AXLE LOAD	MAX SPEED	TOTAL IN SERVICE
VL60	E	33	coco	23	100	28
2VL60K	E	33	2BOBO	23	110	21
3VL80S	E	8	3ВОВО	24	110	32

The VL60 are old (more than 30 years) and have to be replaced. They use 16VL60 for passenger traffic and 20 2VL60 for freight traffic

- 32 VL80 are available for a demand of 29. In addition, the government impose a strategic reserve:
- 29 for service
- 8 for maintenance
- 8 in reserve

We can estimate the actual availability of the locomotive fleet at 70% due to the lack of maintenance (85% is a normal rate)

In conclusion, we can estimate the size of the fleet to 40 locomotives for freight trains.

### 11.3.1.2

#### **Diesel Locomotives**

The number of locomotives in service is 480

The tables below describe type and description of the locomotives fleet.

SERIES	ТҮРЕ	AVERAGE AGE	AXLE ARRANG	AXLE LOAD	MAX SPEED	TOTAL IN SERVICE
2TE116	DE	16	2COCO	21.6	100	48
2TE10P	DE	21	2COCO	23	100	53
2TE10M	DE	11	2COCO	23	100	176
2TE10V	DE	17	2COCO	23	100	81
3TE10M	DE	12	3COCO	23	100	121
2TE2	DE	8	2COCO	21.5	160	0.5

For the current situation, we can estimate that 153 Diesel locomotives are required

The main line diesel electric locomotives have very serious problems because they were delivered with very unreliable engines and auxiliary mechanical equipment. These locomotives have an unacceptable level of failures, specifically with the cooling systems and the mechanical components. The oil leaks show also the serious maintenance problems. They can last about 30 years (18 years for engineers) but the material costs for spare parts and components will be very high, as well fuel consumption.

A solution to these problems is to replace the old diesel engine and auxiliary equipment by GE components. The cost of this replacement is about 0.7 M\$. One modified TE10 locomotive appears to be operationally satisfactory in Kazakhstan.

Moreover, the conversion of the diesel engine on TE10 locomotives should add 15 years or more to the life of the diesel. This conversion will also improve the fuel consumption.

### 11.3.1.3 Shunting Locomotives

No remarks on the TEM2 shunting locomotives enough robust to provide reliable service for 30 years.

For the current situation, we can estimate that 250 shunting locomotives are required according to the Traceca report and 34 according to the UZ engineers.

The size of the existing locomotives fleet is estimate to 313 (63 in reserve, 128 in operation).

The tables below describe type and description of the locomotives fleet.

SERIES	ТҮРЕ	AVERAGE AGE	AXLE ARRANG	AXLE LOAD	MAX SPEED	TOTAL IN SERVICE
TEM2	S	22	COCO	21	100	185
CME3	S	10	COCO	20.2	90	128

11.3.2

#### Recommendations

### 11.3.2.1 Electric Locomotives

UZ need to buy about 10 new modern western electric locomotives for freight trains, in a short term basis, and about 30 after 2010 (3MUS\$ each).

It will be useful to introduce new technologies.

### 11.3.2.2 Diesel Locomotives

Because of the large surplus of the existing Locomotives, no investment is necessary for the next 10 years.

KTZ can continue to operate with the existing fleet by cannibalising and purchasing spare parts.

### 11.3.2.3 Shunting Locomotives

KTZ can continue to operate with the existing fleet by cannibalising and purchasing spare parts.

#### 11.4 Coaches

### 11.4.1 Overview

There are 1454 coaches in the whole UZ manufactured either by Deutsche Wagonbau Ammindorf in Germany or by Russian plant in Tver.

About 200 coaches are out of order due to their age (more than 28 years old).

45% of the fleet is less than 15 years old and most is in a quite poor condition due to the lack of spare parts.

However, the number of coaches is sufficient for the current passenger service level.

The tables below describe the type and breakdown per age of the coaches fleet.

Type of vehicle	before 1960	before 1970	before 1980	before 1990	before 1995	Total
SV	0	0	16	9	2	27
TSMK	1	86	133	196	60	476
TSMO	0	23	365	310	40	738
MObi	0	49	0	0	0	49
P/V	15	24	20	0	0	59
VR	0	2	8	31	4	66
Others	7	20	6	5	<del></del>	39
Total	23	225	548	551	107	1454
%	1.6	15.5	37.7	37.9	7.7	1404

11.4.2

#### Recommendations

The minimum coach fleet is estimated at 600 to meet the current (and future) needs. Almost half of the fleet was purchased after 1980. These coaches will be in operation at least till 2010. The life span of the coaches is 28 years according the Soviet standards.

The rehabilitation of 400 existing coaches has to be engage (50,000 MUS\$ each) for 20 MUS\$, 100 per year.

#### 11.5 Wagons

#### 11.5.1 Overview

There are 32,529 wagons in the whole UR and 40% of the fleet is less than 15 years old. However, the wagon fleet is over-sized for the current freight traffic levels. There is a serious lack of spare parts and the reserve fleet is used to provide parts to the operating fleet.

It is difficult to determine exactly how many of these wagons are presently in operating conditions because of the wide spread cannibalising which has been occurring.

The tables below describe the characteristics of wagons

Туре	before 1969	1970-79	1980-89	1990-95	Total fleet
KR closed	2,169	3,527	2,856	418	8,970
PL, platform	1,652	1,412	1,344	161	4,569
PV, open	693	2,012	3,679	641	7,025
Tank wagons	1,531	1,310	1,362	281	4,484
Refrigerator wagons	167	70	1,564	104	1,905
PR, closed	1,287	828	3,012	449	5,576
Total	7,499	9,159	13,817	2,054	32,529

All wagons have two axle bogies

Speed limit of all types of wagons: 120 km/h

Average service life: 21 years.

11.5.2



### Recommendations

The minimum wagon fleet is estimated at about 9,700 to meet the current (and future) traffics compared to 32,500 available today.

Almost 50% of the fleet have less then 15 years old.

As a result, there is no need for significant investment till 2010. Even it was theoretically suitable to start purchase in 2010, it is practically recommend to start acquisition earlier so as to break down the investment costs over more years. It is not recommended to carry out much wagon rehabilitation because it will not be worthwhile in most cases.

According to the UZ demand, a lack of 600 Tank wagons will appear in 2000. It is difficult to have reliable data's, so we can recommend to purchase 100 Tank wagons per year (25,000 US\$ each)

The scraping wagons will permit to have cannibalised spare parts and decrease the maintenance costs.

## 11.6 Locomotives depots and workshops-recommendations

All locomotive depots are responsible for the operation of locomotives and the management of drivers, first level of maintenance (running repairs) and for the movement of trains.

Some modifications will decrease the frequency of repairs, and thus labour and material costs (wheelsets for example).

TYPE	JOB	PLACE
TO1-T02-TO3	INSPECTIONS	Depot
TR1-TR2-TR3	RUNNING MAINTENANCE	Depot or Workshop
KR1-KR2	OVERHAULS	Workshop

The work force in the depots appears to be skill, well equipped and able to perform all repairs and overhauls.

There is a shortage of spareparts and second hand or reworked parts are used for diesel-electric locomotives.

## 11.6.1 Tashkent workshop

The overhaul activities should be done in Tashkent and need a refurbishment evaluated at 5 MUS\$.

#### 11.6.2



## Diesel-electric locomotives depots and workshops

The depots need to be improved.

## 11.6.3 Electric locomotives depot

The Uzbekistan depot needs to be renew and some adaptation to new technologies; 3 MUS\$.

## 11.7 Coaches depot and workshop recommandations

The Tashkent depot/workshop is able to realise the running and heavy maintenance. It should be improve to perform all repair, overhaul and rehabilitation work required for 5MUS\$.

A 5 MUS\$ of investments should be necessary, including

- a new paint shop.
- · new wheelshop equipment.
- acquire new materials handling equipment
- · renew depots and workshop

## 11.8 Wagons depots and workshops-recommendations

The following depots and workshops should be improved:

- Kokand for running and overhaul maintenance (Tank wagons);2 MUS\$
- Karshi for running and overhaul maintenance; 2 MUS\$
- Samarkand for running and overhaul maintenance; 1 MUS\$
- Kungrad for running maintenance; 1 MUS\$
- Sirdaia for running and overhaul maintenance (Refrigerator wagons); 2 MUS\$
- Boukara for 2 MUS\$

Generally, the core of the maintenance facilities has sufficient capacity, but needs modernisation and maintenance of the workshop and depot building.

A 10 MUS\$ of investments should be necessary, including

- new wheelshop equipment.
- · acquire new materials handling equipment for depots and workshops
- renew depots and workshops
- introduction of new technologies



## Investissement plan-summary

Type of Investments	Costs in Million USS at short term	Costs in Million USS at long term (after 2010)
Locomotives	30	90
Diesel locomotives Depots	5	
Locomotives workshop	5	
Electric locomotives Depot and Workshop	3	
Coaches	20	
Coaches Depot and Workshop	5	
Wagons	15	
Wagons Depots and Workshops	10	
Total	138	90

## 11.10 Comments on the PaDeco investment programm

Padeco report	Amount of the Investment	SYSTRA comments	Amount of the
Electric locomotives: They want to buy -28 VL80: priority 1 -19 V80: priority 2 -15 GEC electrical		They need to buy -10 new electric locomotives for freight train at a short term basis -30 after 2010.	30 MUS\$ 90 MUS\$
locomotives			<u> </u>
Freight wagons: -16,900 are required -600 tank wagons should be purchase	30MUS\$ 21MUS\$	The number of tank wagons should increase, 100 per year for a total of 600.	15 MUS\$
Passenger Coaches -25 coaches; priority 1 -43 coaches; priority 3 -1.32 MUS\$ each coaches	-33 MUS\$ -43 MUS\$	-45% of the coaches (658) are less than 15 years. The rehabilitation of 400 is enough. (50,000 US\$ each) -The cost of a new coach is 0.8 MUS\$	20 MUS\$ on the next 10 years
Electric loco workshop -reconstruction of an existing workshop; priority 1	35 MUS\$	A rehabilitation of the Uzbekistan depot seems enough	3 MUS\$
Wagon workshop -construction of a tank wagon workshop near Bukhara	- 30 MUS\$	Rehabilitation of the existing workshops has to be engage.	10 MUS\$
- construction of a general purpose wagon workshop at Andijan; priority 1	- 30 MUS\$		
Passenger workshop -construction of a passenger workshop	47 MUS\$	The improvement and modification of the Tashkent depot should be enough (wheel and painting workshop,).	5 MUS\$



### Effects of the track electrification

The track electrification will confirm that

- no investment have to be planned concerning the Diesel locomotives.
- The procurement of the new electric locomotives should be advanced.

Moreover, the construction of a new depot for electric locomotives should be necessary in Marakand for 7 MUS\$.

Moreover, the ratio between the number of electric and diesel locomotives is about 1.5 (1.5 diesel locomotive for 1 electric locomotive).

# 11.12 Comparison between electrical locomtive and diesel locomotive operating costs

	Electric locomotive	Diesel locomotive
1-CONSUMPTION		
Consumption per 1000 gross tonne km	12 kW	7.1 litre
Cost of a kW or a litre in Sum	4	16
Cost of a loco per 1000 gross tonne km	48	113,6
Number of gross tonne transported	2,600,000	2,600,000
Cost for one year in Sum	124,800,000	295,360,000
Difference in Sum	170,560,000	
2-SPARE PARTS		
Spare part cost per km in US\$	0.5	0,7
	(70% of the equivalent D/E cost)	.,.
Spare part cost per year (100,000 km) in US\$	50,000	70,000
Difference in US\$	20,000	

### 11.13 spare parts

The amount of 15 MUS\$ of spare parts (Traceca and Padeco reports) seems a good approach.

# 11.14 Technical and Financial analysis of the replacement of the TE10 engine by a GE component.

This analysis has studied the technical and financial aspects of the modification of a fleet of about 100 loco 2TE10.

This modification consist to replace the diesel engine and auxiliary equipment by GE components (including Diesel engine, Generator, Air Compressor, Cooling circuit, ).



We have made the following assets;

- 1. The replacement the equipment should add 15 years to the life of the locomotives.
- 2. The selected loco should be about 10 to 12 years old and electrical systems in good condition and overdue of KR2.
- 3. UZ will made a KR2 during the modification and especially replace the Traction Motors, wheels, etc.

Considering that the replacement of the engine will add about 15 years to the life span of the locomotives, we decided to study the effects on 15 years.

The data come from the railways.

## 11.14.1 Analyse of the Maintenance and Accidental Repairs

During this period of 15 years, the maintenance plans, the number of Accidental repairs and the stop times will have a significant impact.

## 11.14.1.1 TE10 engine

The following tables gave the total Maintenance and Accidental repairs costs for a TE10. More ever, the theoretical availability rate is precise.

Hypothesis	
Km/year	110000
Hours/year	3000

Maintenance Repairs						
Maintenance Operation	T03	TR1	TR2	TR3	KR	TOTAL
NO of Operaration for 15 years	270	62	11	8	3	
Average stop duration /OP (h)	24,8	50,1	238	298	502	
Average stop duration /OP for 15 years (h)	6696	3106,2	2618	2384	1506	16310,2
Average stop duration /OP for 1 year (h)	446,4	207,08	174,5	158,9	100,4	1087,3
Cost / OP (\$)	285	950	20130	49875	66500	
Total cost for 15 years (\$)	76950	58900	221430	399000	199500	955780
Total cost for 1 year (\$)	5130	3926,7	14762	26600	13300	63718,7

Accidental Repairs	
NO AR/1.000.000Km	95
Average stop duration /RA (h)	115
NO AR/year	10,45
AR stop duration/year (h)	1201,75
Total cost for 15 years=Maintenance cost (\$)	955780
Total cost for 1 year=Maintenance cost (\$)	63718,7

Total cost for Maintenance and AR for 15 years (\$)	1911560
Total cost for Maintenance and AR for 1 year (\$)	127437,4

Availability Rate (%)	73,9
1	

## 11.14.1.2 TE10 modified with a GE Engine

Hypothesis	
Km/year	110000
Hours/year	3000
Hour cost (\$)	5

Maintenance Operation	1/92 days	1/year	1/2 years	1/3 years	1/4 years	KR	Total
NO of Operation for 15 years	29	13	6	4	2	1	
Average stop duration /OP	1,5	1,3	4,8	2	0,5	30	
Average stop duration /OP for 15 years (h)	43,5	16,9	28,8	8	1	30	128,2
Average stop duration /OP for 1 year (h)	2,9	1,1	1,92	0,5	0,067	2	8,5
Cost / OP (\$)	39	31,7	121,3	- 10	5	1745	
Materials costs (without oil)/OP (\$)	879	50	1691,6	Ö	60	38419	
Total cost/OP (\$)	918	81,7	1812,9	10	65	40164	
Total cost for 15 years (\$)	26622	1062,1	10877,4	40	130	40164	78895,5
Total cost for 1 year (\$)	1774,8	70,8	725,16	2,7	8,7	2677,6	5259,7

Accidental Repairs	
Average stop duration /AR (h)	8
NO AR/year	1
AR stop duration/year (h)	8
Material cost for 1 year (\$)	800
Total cost for 1 year (\$)	840
Total cost for AR for 15 years (\$)	12600

Total cost for Maintenance and AR for 15 years (\$)	91495,5
Total cost for Maintenance and AR for 1 year (\$)	6099,7

Theorical Availability Rate	(%)	99.8
	1 - 7	1,-,

In this study, we do not take account of the duration for the transport of the locomotives to their depots.

We have considered that the cost of the AR is equivalent to the cost of the maintenance repair. Usually, we consider that this cost is 10% higher.

The availability rate of 74% for the TE10 given by the railways should be decreased to about 70% in our opinion.

The Theoretical Availability Rate of 99,8% for the modified locos is too high. In fact, the remaining equipment of the TE10 (Traction Motors, Bogies, Brake system, etc.) responsible of 20% of the AR, should impose a decrease of this ratio to about 90%.

In consequence, the difference of the two ratios, about 20%, should allowed KTZ to use 80 modified locos in place of 100 TE10.

## 11.14.2 Analyse of the Fuel oil and Lubrication oil costs.

Hypothesis	
Cost of 1t of Fuel oil (\$)	150
Cost of 1 t of Lubrication oil (\$)	500

#### 11.14.2.1 Fuel oil

	Russian Engine	GE Engine
K/loco for 1 year (t)	934	533
K/100 locos for 1 year (t)	93400	53300
K/100 locos for 15 years (t)	1401000	799500
Cost for 1 year (M\$)	14.01	7.995
Cost for 15 years (M\$)	210.15	119.9



This data gave by the railways can be verified by the following calculation;

- the total Fuel consumption per year is about 4,4MT, about \$60.000.
- the number of locomotives is about 500
- the cost of 1t of Fuel is about \$150

The result is about 800 t per locomotive and per year.

This consumption per locomotive is astonishing, because if we made a calculation using the following ratios (gave by KTZ and GE engineers) the results are very different.

	TE10	Modified locomotives
Fuel consumption kg.	0.21 kg./hp-hr	0.16 kg./hp-hr
Average daily running time (hr)	8	8
Horse power	3,000	3,000
Consumption per day (t)	5	3,84
Number of day running	350	350
Consumption per year (t)	1750	1344
Consumption per year /100 Loco (t)	156100	134400
Cost for 1 year (MS)	26,2	20,16
Cost for 15 years (\$)	393	302,4

## 11.14.2.2 Lubrication oil

	Russian Engine	GE Engine
K/loco (t) for 1 year	10,96	5
K/100 locos (t) for 1 year	1096	400
K/100 locos for 15 years (t)	16440	6000
Cost for 1 year (M\$)	0,548	0,2
Cost for 15 years	8,22	3

If we use the ratios utilised by the KTZ engineers, the results are also very different.

	Russian Engine	GE Engine
K/loco for 1 year	4% of the total Fuel oil consumption	0,5% of the total Fuel oil consumption
K/loco for 1 year (t)	70	7
K/100 locos (t) for 1 year	7000	700
K/100 locos for 15 years (t)	105000	10500
Cost for 1 year (M\$)	3,5	0,35
Cost for 15 years (M\$)	52,5	5,25

11.14.3

## Total running costs

We saw before that 80 modified locos are enough in place of 100 TE10 to assume the same operations.

In consequence, we can start the investment plan using 80 modified locos, compared to 100 TE10.

	TE10 Loco		Modifi	ed Loco
	1 Year	15 Years	l Year	15 Years
Maintenance and AR costs for 1 Loco (\$)	127.438	1.911.560	6.099,7	91.495,5
Maintenance and AR costs for the equivalent of 100 Locos (M\$)	12,7	191,1	0,488	7,3
Fuel oil (M\$)	14	210,1	8	120
Lubrication oil (M\$)	0,548	8,22	0,195	2,932
TOTAL (M\$)	27,3	409,5	8,678	130,177
Economical effect (M\$)			-18,6	-279,3

If we use the ratios we will have the following results.

	TE10 Loco		Modified Loco	
	1 Year	15 Years	1 Year	15 Years
Maintenance and AR costs for 1 Loco (\$)	127.000	1.900.000	6.099,7	91.495,5
Maintenance and AR costs for the equivalent of 100 Locos (M\$)	12,7	191,1	0,488	7,3
Fuel oil (M\$)	26,2	393	20,16	302,4
Lubrication oil (M\$)	3,5	52,5	0,35	5,25
TOTAL (MS)	42,5	638,2	21	315
Economical effect (M\$)			-21,5	-323,2

The difference per year is -\$21,5 mus in place of \$18,6 mus

## 11.14.4 Cost of the modification

Hypothesis	
Hour cost (\$)	5

Total cost (\$)	55.124.000
Modification cost/ 80 Motors (h)	800.000
Modification cost/ 1 Motor (h)	10.000
Modification duration/ 1 Motor (h)	2.000
Tools (\$)	400.000
Transport cost of 80 GE Equip (\$)	1.920.000
Transport cost of 1 GE Equip (\$)	24.000
Cost of 80 GE Equipements (\$)	52.000.000
Cost of 1 GE Equipement (\$)	650.000

The total modification cost will be about \$M55, compared to the \$M18,6 profits per year on the running costs.

These calculations show that if the modifications are done in one year, that the investment should be paid in 4 years (3,65 years with the ratios).

These locos should be in operation until 2015.

### 11.14.5 Conclusion

A unit of a 2TE10 is constituted of 2 locomotives of 3000 hp. A new CC locomotive TERA1 (RE mean Russian and American) should be produce in Ludinova (Russia) for a cost of \$3 mus after 1999 with a General Motor engine. This locomotive of 4000 hp should be capable to hauled 4500t (the average train weight is about 3000t) on a gradient of  $9^{\circ}/00$  ( $\gamma=0,33$  compare to 0,22 of a TE10). The speed limit will be 115 km/h.

We will have the same advantages with this locomotive than with 2 modified locomotives, in terms of Operating costs. Moreover, this locomotive is designed for 35 years.

The problem is that if they buy new locomotives, they should be obliged to

- modify Depots and Workshops
- make workers training's on new technologies
- buy new tools
- buy new spare-parts
- etc.

Moreover, due to the future development of the track electrification, we recommend to modify a part of the fleet than buy new one's.



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## 12. Management Information Systems

#### 12.1 Overview

The information system of the Uzbekistan Railways (UTY) was designed, developed and installed in the late 1970's according to maintenance and operation rules defined in Moscow. These systems were designed to help achieve higher technical efficiency, possibly at the expense of economic efficiency (longer routes than needed, too many shunting operations partially offset by higher train loads, ...).

They consist mainly of two large applications:

- ASOUP for freight,
- EXPRESS 2 for passenger business.

Close to nothing could be changed since independence.

A few offices have computers; they are not networked, and are mainly used for work processing.

Therefore, it's important to re-think the information system according to the new needs of users, and making the best possible use of the existing technology.

Telecommunications are based on Soviet technology.

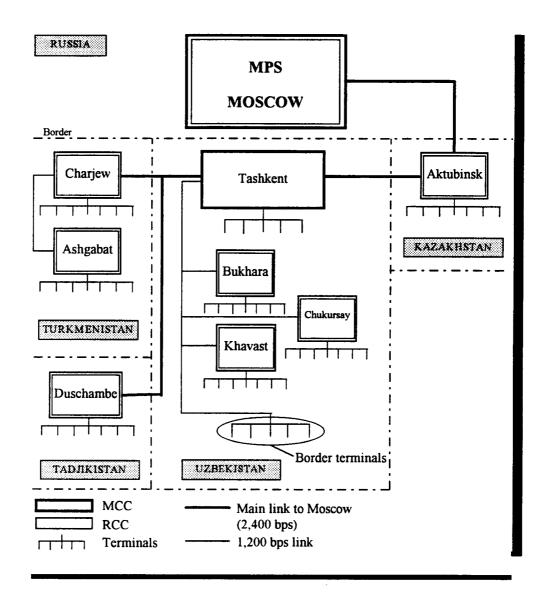
## 12.2 Existing Management Information Systems (M.I.S.)

#### 12.2.1 M.I.S. structure

In the soviet time, Tashkent had the main Computer Centre of Central Asia. This Computer Centre is manned by 300 staff members. The head of the Information Department noted that its processing capacity was limited, which is why it does not process accounting data.

However, it does carry out a few traffic-related operations to assist Turkmenistan and Tadjikistan.

The RCCs are also connected to the Main Computer Centre (MCC) located in Moscow.



OSZhD (CIS Railways Transport Council, operating since 1992) countries are in the process of defining a new convention regulating cross border information exchanges - format and contents. The last - 18th - session of OSZhD meetings took place in Tallinn, Estonia on May 26th and 27th, 1997. Signature of the agreement is expected by the 20th or 21st meeting, i.e. by the end of 1997 or the begining of 1998.

As a result of the new convention, UTY will be able to channel data flows through Tashkent, where they can be used for their own purposes, and relevant data forwarded to neighbouring countries.



It will also create the possibility of choosing their own information systems, actually replacing ASOUP and EXPRESS, or to influence more strongly the further development of the systems, or still to adapt them to local requirements.

The present information system, designed and installed in the late 1970s, is based on IBM compatible equipment and consists of two main independent networks:

- EXPRESS 2: a passenger information system (P.I.S.),
- ASOUP: a freight information system (F.I.S.).

The two systems use separate, dedicated low speed analog links between computer centres and terminals (1200 bps (bits per second)).

### Follow-Up of Freight Traffic

The consignment note for each shipment is used to create a database.

Other information is also entered in this database: facts concerning loading and unloading operations, routes (origin, destination, train make-up, etc.).

All data are provided by entities in the field (freight stations, shippers, marshalling yards).

Data are centralized at the computer center of Tashkent, which processes the data.

The results for month M are available on the 10th of month M + 1.

Data concerning international traffic are processed by a specific entity (a center set up to oversee international payments and contracts).

The only management departments to be connected to the computer center are those responsible for traffic (centralized train control) and statistics (to estimate daily traffic volume).

### Follow-Up of Passenger Traffic

The Express 2 system collects data concerning regional and international passenger traffic. Station terminals are hooked up to the computer center, which processes all data. Again, the results for a given month M are available on the 10th of month M + 1.

Suburban traffic data are centralized at the regional division level and sent each month to the computer center.

### Regional Computer Centers

Their purpose is to centralize, at regional level, all accounting data needed to draw up periodic balance sheets for the regional division itself or its Establishments.

They receive all documents filled in by the workshops and crews. Data contained in these documents are then entered and assigned values. Virtually all of the elements needed to draw up a balance sheet appear on this statement, which is then sent to each Establishment for verification. Any errors are corrected by the Computer Center and a new statement issued the following month.

These computer centers are equipped with Latvian-made computers (the 1984 VKM-5100 or the '90s SMK00 models) with 13-megabytes hard disks, able to transfer data onto magnetic tape.



The software and processing methods developed by rail computer staff may vary from one division to the next, but their statements of results comply with set standards. The languages used to develop software are Fortran 77 for data entry and preparation, and Assembler for all computing. Some divisions still use the program that MPS developed in the 1970s. It is difficult and sometimes even impossible to retrieve processed data (incompatible file formats).

Data are stored in the memory for no more than two months.

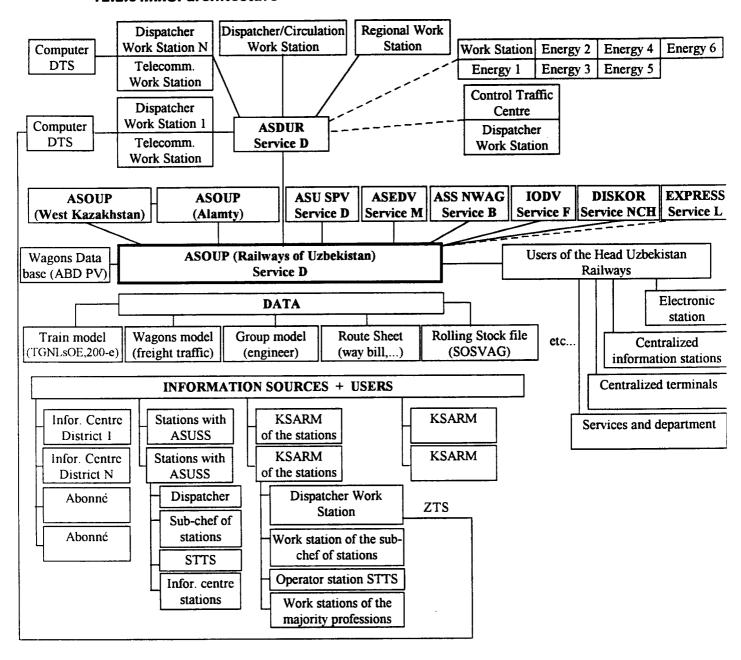
#### **Comments**

Data processing methods are the same as those implemented by the MPS in the ex-USSR prior to independence. Therefore, it is very difficult to make queries and access programs to modify or expand existing processing methods.

12.2.2



### 12.2.3 M.I.S. architecture



#### Terms and abreviation

ARM:

Automated work station

DNTS:

Train dispatcher

DNTSO:

Distance operator



ORU:

Regional management operator

ETCHTS:

Energy dispatcher

Train Model:

Database on train information development in the real time regime

Wagon Model:

Database on wagon information development

Group Model:

Data base on engine-drivers group information

DTSU-E:

Control Traffic Centre

DTS:

Dispatcher Centre

**ASDUR:** 

Automated system of regional dispatching management

ASOUP:

Automated system of operative management

**ASEDV:** 

Automated system way bill of railway development

ABD PV:

Automated data base of railway and enterprise wagons

SOSVAG:

Inquiry file system of wagon fleet

**ASUSS:** 

Complex system of automated work places

KSARM:

Complex system of automated work places

PKI:

Information concentration point

IODV:

Integrated railway memorandum bill development

DISKOR:

Dialog information control system of operative work

**ASU SPV:** 

Automated management system of wagon transferring between countries

**ASS NVAG:** 

Automated wagon tracking system (transferring and repair)

#### 12.2.4 Software

Originally, MPS planned the implementation of 18 MIS modules, to be developed by Moscow. The five main companies of the MPS are:

- P.K.T.B. (Technology Bureau for Construction and Projects in Moscow)
- ACOUGT
- VNIGGUE
- TSITTRANS
- GUE VTS MPS Russie

All could not be developed, and only two (see above) could be implemented in Uzbekistan. They have been operating since the 1970s. Local adaptations were made.



12.2.4.1



## 12.2.4.2 Passenger Information System (P.I.S.) - Express 2

The EXPRESS 2 system collects data concerning regional and international passenger traffic.

EXPRESS 2 handles the sale of tickets, seat reservations, cashier operations, tracking of parcels and mail items. This system was implemented in Uzbekistan in the 80's. Prior to this, each railway had its own system. EXPRESS 2 is connected to the MCC in Moscow. The points of sale are equipped with a PC connected to the RCC. Any type of ticket can be sold, one-way or return, from or to all stations in Uzbekistan and the CIS republics. The fare structure is incorporated into the system and updated locally.

Station terminals are hooked up to the RCC, which processes all data. Again, the results for a given month are available on the 10th of the next month.

Suburban traffic data are centralized at the regional division level and sent each month to the computer center.

A new version of this system EXPRESS 3 will be in operation by 2000 and will provide additional information on passenger traffic. The system will operate on IBM 9672 computers (S/390 system). This system will be developed by Moscow.

## 12.2.4.3 Freight Information System (F.I.S.) - ASOUP

ASOUP works on-line with the MCC in Moscow. It provides access to a data base containing trainspecific information such as train number, trailing load, net loads, type of lading, consignee, origin and destination, wagon tracking, location of the shipment in each train; plus train planning data such as traffic movement plans, wagon and locomotive utilisation and penalties for wagon idle time.

## 12.2.4.4 Other existing applications

The other data processing methods are also inherited from MPS in the USSR times prior to independence. It has a built in batch processing orientation; on line transaction processing is practically non existing, and can not be implemented without significant changes in architecture.

No maintenance management system does exist, in spite of large amounts of money at stake.

The same applies to accounting and human resources management.

The financial department makes use of a decicated decision support system that delivers profitability measures for the various activities of the Railways. This software, "SysManagement", was introduced as part of the Traceca Tarification project, and personnel of UTY and colleagues in the other Traceca countries were trained to use it and to apply consistent economic principles.

12.2.5



#### 12.2.6 Hardware

Basically all RCCs have the same type of computer hardware and dataprocessing functions as are found in all the independent republics of the former USSR.

The mainframes are IBM 4381, HDS LX-50 and P.C. 486.

		Main frame
Tashkent RCC	F.I.S.	2 HDS LX-50
	P.I.S.	2 IBM 4381
Khavast RCC	F.I.S.	2 P.C. 486
	P.I.S.	None
Bukhara RCC	F.I.S.	2 P.C. 486
	P.I.S.	None
Chucursay RCC	F.I.S.	2 P.C. 486
	P.I.S.	None

The IBM 4381 computers were bought second-hand and installed in 1995.

The P.I.S. operates with 100 antiquated terminals (like EC 7927-01 type of IBM 3270). These were rehabilitated since 1989 with hungary technologie.

#### **Local Computer Conditions**

Some of the offices we visited are equipped with PCs. This equipment is mainly used for word processing and other packaged software.

## 12.2.7 Communications

#### 12.2.7.1 Hardware

Communications within are based on

- twisted pair wires laid alongside the track, on most tracks,
- internal telephone network and access to KT network,
- radio transmission with locomotives,
- internal data transmission.

#### 12.2.7.2



## 12.2.7.3 Transmission systems

The transmission systems covered here are those which link various stations and other locations used by UTY. These are all older carrier systems of Russian origin using frequency division multiplexing (FDM). They fall into two categories, the buried copper cables and the open wire lines.

### Open wire lines

The open wire transmission carrier equipment is old. These systems have been or are being discontinued world-wide. Most of the open wire lines are found in the bwestern region, including most of the line from Tashkent through Aktyubinsk on to Russia. The open wire lines make up over 50% of the total transmission link route.

The open wire carrier transmission equipment has a 3-channel and a 12-channel carrier system. In general these systems are noisy and limited to telegraph speeds for data.

#### Cable links

Buried cables make up the other half of transmission links. Cables are jacketed and armoured for direct burial in a trench on the right of way. Cables are buried at a depth of 0.8 to 1.2 meters standard for cold climates. There are problems of corrosion in many places due to water ingress which may be accelerated by chemical contaminents in certain segments.

The cable reel sizes are limited by weight to lengths of between 850 to 1,000 meters. This means a splice at intervals of 1,000 meters at best. In addition, cables must be spliced at every signal and electric switch need to be controlled in the CTC zones. Finally, amplifiers are necessary every 20 km on average, adding further splice locations.

Splice points are problem points in any cable system. The most of the corrosion problems occur at splices.

### • Functional uses of transmission circuits

Transmission circuits from the two systems described above are used for the following:

- to link the various private telephone exchanges of the railways,
- for dispatcher communications to stations,
- for linking radio base stations to dispatch,
- for station-to-station telephone,
- for control of signals and electric switches (CTC),
- for data transmission.

#### 12.2.7.4



#### 12.2.7.5 Data transmission

Dedicated lines are allocated to the MIS department for their data communication needs. These lines operate at maximum 1,200 bps.

Interruptions in line transmission lasting more than one hour at a time occur about three times a week; these disruptions are effectively more harmful. It is likely than the situation is worsening, though no statistics are available.

UTY's MIS systems still depend on the Russian Railways' centralised MIS in Moscow. Because of the poor quality of transmission, UTY leases lines from the telecommunications company to ensure data communications between their computer centres and Moscow. Because the Russian Railways are planning to install a packet data network, UTY be forced to adopt similar systems or become autonomous.

Future developments requiring linking the UTY MIS computers into a network will be dependent on improved quality and possibly higher transmission capabilities.

### 12.2.7.6 Telephone network

Old cross-bar and step-by-step exchanges of Bulgarian and Russian origin represent the bulk of telephone exchanges. The majority of intra-railway long distance communication is handled through operators and patch-boards.

As it is hopelessly obsolete, it provides the opportunity for major overhaul with state of the art technology.

### 12.2.7.7 Radio systems

The radio system is used to communicate with trains. There is a base station at every station and all operating locomotives are equipped with a radio in the cab. The radio system uses lines from the transmission system to link the base stations and the control traffic centres.

Two types of radios exist: a 2 Mhz system which is used on electrified sections only and a VHF radio system at 150-156 Mhz. All locomotives are equipped with a radio. Passenger locomotives have both radios. Freight locomotives only have the VHF radio. Information regarding radio equipment was sketchy and inconsistent.

#### 12.3 Planning for MIS requirements

### 12.3.1 General considerations

We may distinguish between:

- increasing the functional coverage
- upgrading the systems



12.3.1.1



## 12.3.1.2 Existing systems (Asoup and Express)

The only significant flaw in the existing systems, besides relying on obsolete telecommunication technology (which can be remedied separately), is their absolute dependancy on Moscow for development, implementation and, most importantly, operation.

It must be stressed however that joint work on, and joint use of technically or operations orientated software systems is highly desirable, as trains cross national boundaries, and there is a considerable common culture, including the use of the Russian language.

Focus should therefore be laid on making these systems more balanced, carefully avoiding unuseful dependancy on centralised data processing or data flows. Most data collected in Uzbekistan are primarily of use to Uzbek railways and their customers, and UTY should feel free to get organised their way to collect and process data for their own and the common purposes.

The standards to be provided by OSZhD will make it possible; UTY can therefore anticipate and implement information systems that make use of the data traditionnally available only from Moscow.

## 12.3.1.3 Increased functional coverage

It can be argued that many management processes could be computerised at UTY.

Computerisation is however only part of the picture; remodeling management processes, to ensure that MIS will support company strategy and allow management to make the economically and operationnally right decisions, is an abolute requirement.

Therefore, the focus for the remainder of this assignment will be laid on prioritizing and putting into perspective the need for implementing computer software, hence allowing rough scheduling, sizing and technical definition of future related investment. It should however fall short of a full fledged computerisation master plan.

## 12.3.2 System design requirements

## 12.3.2.1 Freight Transport Management System (F.T.M.S.)

The main activity of UTY is the transportation of goods from one place to another. This includes:

- to actually move the goods: transportation function
- to price and invoice services: commercial function
- to maintain the rolling stock in proper condition: rolling stock function



In order to improve their competitiveness, UTY should:

- improve the quality of service without compromising on safety issues
- reduce operating costs

At this time, only the transportation function is computerised (ASOUP system). Other processes are implemented manually. It is recommended to computerise following applications:

## 12.3.2.1.1 Freight Information Application (F.I.A.) - Asoup

The existing F.I.A., called ASOUP, delivers the expected services, and will keep doing so for the next five years, according to UTY experts. Even if it was designed a long time ago, the functions implemented cover most existing needs.

As its effectivness is highly dependent on the telecommunication systems being used, it is appropriate to await these systems be upgraded. This would allow UTY to postpone making decisions on this matter for another five years, at which stage the hardware used by ASOUP would be obsolete and possibly worn out.

In the short term however, more terminals are needed for inputting data in the field, using the existing telecommunication network.

The F.I.A. should make wagon booking possible at short notice. Detailed information on commodity, revenues, tonnes, loads, wagon types, wagon km, origin-destination pairs and revenue should be collected to produce freight traffic statistics for use by marketing, tariff staff and rolling stock maintenance.

## 12.3.2.1.2 Freight Marketing Management Application (F.M.M.A.)

F.M.M.A. should implement all truly commercial functions:

- customers files,
- information to clients,
- real time computation of costs,
- pricing and invoicing,
- delivering statistics on sources of revenue.

It is important to implement it first in a single "information centre" in Tashkent, before it would be decentralised, pending implementation of better information systems.

## 12.3.2.1.3 Wagon Use Application (W.U.A.)

The main trigger for maintenance jobs is the time wagons were available for work, instead of some more relevant parameters such as tons.kilometers.

It is therefore recommended to significantly improve the maintenance policy, and to build the appropriate information system, tons kilometers are an obvious candidate, as are the results of various inspections and checks to be carried out and kept on file.

W.U.A. is an obvious component of the Rolling Stock Management Application.



12.3.2.2



## 12.3.2.3 Passenger Management System (P.M.S.)

Passenger transportation, while obviously less critical than the transportation of freight, is of vital importance to the country.

The existing P.M.S., EXPRESS 2, meets today's requirements. Further investment at this stage can hardly be justified on pure economic grounds, possibly for the next five years.

Equipping further stations is however thinkable, pending improvement of telecommunication systems.

The Russian developer of EXPRESS is due to release version 3 any time soon, which would deliver more detailed information on revenues, passengers, passenger km, O/D statistics; in particular detailed marketing information using train numbers and types of seating and also fares, which would enable UTY to implement modern marketing practices.

Given the size of the country however, passenger trains are hardly a competitor to airlines; as a result drastically improved marketing management practices may be difficult to justify on pure economic grounds as well.

## 12.3.2.4 Administration Management System (A.M.S.)

## 12.3.2.4.1 Finance and Accounting Management Application (F.A.M.A.)

The use of a F.A.M.A. in any enterprise is essential as it is a necessary condition for the financial and economic management of all processes. It provides the necessary basis for founding most economic decisions, and allows the near real time monitoring of the use of the company resources, to be measured agains the appropriate benchmarks.

Today's management practices mostly encompass a mix of

- USSR time operating routine, well adapted to stable, high demand and forced loyalty of suppliers, but ill adapted to reduced traffic, tough suppliers, changing customers expectations and demand patterns, and open competition from other modes of transportation
- crisis management, allocating in a very centralised way (and therefore too unprecise) the little resources available (cash, hard currency, material resources, manpower, ...)

The increasingly market based economy requires

- changes in culture, towards systematic economically founded decisions,
- profound reforms in administration, towards greater decentralisation and related increased accountability of mid level managers
- structural modifications, towards the creation of well focused business and operating units
- ... that are only possible with new information and management systems, well adapted to the challenges ahead, while minimising disruptions that could arise from too quick, too radical changes.

#### 12.3.2.4.2



# 12.3.2.4.3 Personnel Management Application (P.M.A.)

Presently, there is no computerised tool for personnel management in UTY. Each entity manages its proper personnel with the budget allocated by the Financial Department of Head Office. The daily routine personnel management duties (promotions, benefits, payroll, etc.) are decentralised and located on site and at unit level using mostly hand written forms. As a result, no reliable consolidation is done at Head Office level. Thus, it is highly recommended that a (standard) Personnel Management Application be implemented.

# 12.3.2.5 Maintenance Operation System (M.O.S.)

# 12.3.2.5.1 Infrastructure Management Application (I.M.A.)

The increasing complexity in maintenance requirements has presented a challenge to operators. The infrastructure requirements range from activities concerning construction, maintenance and repairs of railway lines, construction works, signaling and automation systems. The purpose of the Infrastructure Management Application is to provide reliable information across the organization covering the infrastructure construction and maintenance projects, investments for railway infrastructure, resources allocation and utilization. The proposed system will provide the following benefits:

- maintenance management,
- infrastructure projects management,
- cost control.
- investment control,
- · resources control.

# 12.3.2.5.2 Rolling Stock Management Application (R.S.M.A.)

The Rolling Stock Management Application should provide a complete solution, including application software and adequate hardware. The solution should include technical documentation management for the rolling stock.

The Application Software should provide the following modules:

- rolling stock assets management,
- maintenance management,
- store and stock control,
- rolling stock technical documentation management.

All the modules should share a common rolling stock inventory database.

### 12.3.2.5.3



## 12.3.2.5.4 Train Circulation Management Application (T.C.M.A)

The main objectives of the Train Circulation Monitoring Application are to provide timely and reliable information across the company, concerning the train circulation services to be offered for freight and passenger operators. The application should provide information covering circulation requirements, circulation time tables and planning, circulation statistics, analysis and forecasts.

## 12.3.3 Integration requirements

Integration of applications is an extremely important requirement under UTY needs. Apart from the general requirements of interfacing, it is essential that the applications be able to pass the relevant data accurately and rapidly between each other and permit easy integration with future MIS components, without requiring the duplicated efforts of input or other processing.

The application software should execute in an integrated fashion across all hardware platforms/levels on the processors and communicate with each other via the system network, to accomplish the specified response time.

The solution must follow some integration principles, as:

- entry of data at the point of activity,
- well-defined procedures for dependent transactions without compromising on system flexibility,
- · timely availability of data where needed,
- interfaces / integration with the existing or new applications,
- open to integrate further application,
- open for functionality upgrade and application development.

The integration of applications should cover:

- integration between each application's modules,
- integration between the applications, as following:

Infrastructure Management Application - Train Circulation Monitoring

- speed restrictions due to the infrastructure technical status,
- clearance gauges,
- line sections closed for maintenance or repairs works,
- basic data for time tables settlement (distances, line's profile, maximum speeds, etc...).

Train Circulation Monitoring Application - Freight Transport Management Application

- transport requirements,
- time tables and circulation programs,
- circulation tariffs for freight trains.

Infrastructure Management Application - Freight Transport Management Application

- clearance gauges (for loading);
- infrastructure's tariffs for the freight transport.



Infrastructure Management Application - Rolling Stock Management Application

- clearance gauges;
- technical conditions required for rolling stock;

Rolling Stock Management Application - Freight Transport Management Application

- freight wagons allocation (active wagon fleet),
- locomotives and crew allocation for freight trains,
- rolling stock's tariffs for the freight transport,
- wagons and locomotives current activity.
- integration of each application with the Financial and Accounting Application:

Infrastructure Management Application

- maintenance costs,
- expenditures,
- incomes,
- materials purchasing and providers' list,
- infrastructure's fixed assets.
- infrastructure's investments data

## Rolling Stock Management Application

- maintenance costs,
- expenditures,
- incomes,
- rolling-stock assets,
- rolling stock and materials purchasing and providers' list.

## Train Circulation Monitoring Application

- circulation costs,
- expenditures,
- incomes,
- materials purchasing and providers' list.

## Freight Transport Management Application

- costs,
- expenditures,
- incomes,
- materials purchasing and providers' list,
- transport contracts data.

#### 12.3.4

## 12.3.5 System architecture

## 12.3.5.1 Client / Server requirements

MIS architecture should comply to open system standards thereby reducing dependence on a single hardware supplier, protect UTY against rapid obsolescence and escalating maintenance costs, and insure interoperability of all the system applications.

The system architecture should take advantage of client/server processing. The Application Software, either customized or developed, shall have the following characteristics:

### • Configurability

The applications should be reconfigurable so it can be adapted to meet the needs of the UTY according to its restructuring processes.

### • Platform neutrality

The application architecture must be independent of the platform(s) on which it is deployed. All operation system, communication and database services should be implemented as abstractions. The final objective should be to be able to deploy any component of the application on a multitude of platforms from a single set of source code. One important objective is to locate the application function close to the business expertise.

### • Extensibility

The applications components should be extended without modification of the basic code. Where possible, the business rules which are likely to vary between Clients should be separated from the core business logic. In this perspective, the development staff should be able to define subclasses of an object class to add new functionality for the application.

#### • Interoperability with other software applications

All the applications must provide two-way interfaces for industry-standard compound document technology (i.e. OLE). They must be able to exploit the capabilities of products like spreadsheets, word processors, graphic packages, multimedia presentation.

## • Ease of maintenance

The architecture must ensure that the application components may be maintained by local programmers. The architecture should divide the complexity of the applications into manageable domains with well defined, narrow interfaces. It also should include tools that help the change management and version control.

## • Ease of learning and use

Considering that each personnel staff member, using the applications, are assuming more diverse responsibilities and are interacting with many different components of the UTY information system, they do not have the time for long learning curves. In this perspective, the application software must be easy to learn, intuitive and must reflect the mental picture of the business objects, associations and work activities with which users are familiar to.

The user interface must be consistent between components and be consistent with industry standards. The user interface and the reports must be in Russian language.



12.3.5.2



## 12.3.5.3 System Architecture for Data Warehouse

For the management information system is required a Data Warehouse architecture with the following components:

On Line Analytic Processing component which will be the link between the users' applications and the data available from the data warehouse. This component will have the following functions:

- embodies the enterprise business model;
- dynamically maps between the business model and the data model which represents the underlining data available from the data sets;
- provides customized views of the data;
- provides an Application Programming Interface (API) for users' applications and support standard data interchange formats both to standard front-end tools (like spreadsheets) and to GroupWare distribution tools;
- provides predictable response time;
- incorporates query policing and scheduling capabilities to reject (or at least check) queries that appear to have long execution times and to allow prioritizing and deferred execution of acceptable queries.

Integrated Data Sets component, which provide the data for analysis component and is conceptually a single database holding integrated enterprise data. It may be possible that these data sets provide data back to the operational environment, and in this case the operational data should be held in a physically separate database to avoid decision queries impacting operational response times.

The Integrated Data Sets shall be:

- read-only: users cannot update it, in order to preserve the simple, consistent view of corporate data.
- responsive: must support the required query response time and must not impact the operational performance,
- secure and manageable.

The primary data for the Data Sets comprise:

- current operational enterprise data,
- held in physically heterogeneous and disparate data sets and/or machines,
- divers represented,
- duplicated, especially when packaged applications are used,
- change of data field use over time,
- owned by different departments.
- historical operational enterprise data, generally between 5 and 10 years of information, for trend analysis,
- external data.



The data stored in the Integrated Data Sets should be:

- summarized data,
- detailed current and near-current data,
- summarized historic data.

Synthesis Process component must extract, cleanse, transform, integrate and migrate the disparate primary data to achieve the integrated view presented by the Data Set. It must, therefore address all the aspects of the primary data presented above. Management and automation of the synthesis process shall be ensured through the meta data component.

The synthesis process is the most important in the development phase, for:

- identification of sources for required data,
- integration of data from different sources,
- elimination of duplicates,
- insertion of missing data,
- mapping data onto Integrated Data Set schemes,
- management of the initial transfer to the Integrated Data Set,,
- management of updates to the Integrated Data Set,
- management of requests to reach-through to source data via the Integrated Data Set.

Meta Data component, containing "data about the data", and are:

- analysis meta data, with the business model, the data description corresponding to the views of the business model and the mapping between the data description and the Integrated Data Set,
- synthesis meta data, with details of the source (platform, DBMS, schema), details of data items to be extracted, mapping of items and business rules for transforming data.

#### 12.3.6 Software requirements

#### 12.3.6.1 Administration Management System (A.M.S.)

### 12.3.6.1.1 Finance and Accounting Management Application (F.A.M.A.)

There is a prevailing thinking that today's problems and vexations are primarily due to the current economic downturn, that broke havoc with the well functioning systems and practices of the recent past.

This is absolutely true, but does not imply that no changes are necessary in the mangement culture and practices.

In particular, two changes are irreversible, and must be coped with:



- the level of demand has decreased drastically, and may never get back to previous levels; as a
  result, less financial resources will be made available to the railway, which will have to use less
  resource intensive operating and maintenance practices,
- the railway are facing a constantly changing environment: patterns of demand, prices for supplies and services, prices charged by competitors, government regulations, technology made available (traction, multimodal, ... information systems).

This justifies implementing management practices that allow the organisation to cope with changes, and implementing the related tools, including information systems.

### Specific changes needed

Among other important changes needed, interviews with the management of UTY and experience gained on the implementation of Systra's software package "SysManagement" (as part of TRACECA "Tariff and Timetable Structure" project) evidenced serious shortcomings in the generation and use of accounting and statistical information, and have stressed the relevance of following orientations:

- make corporate strategy more explicit, so that individual units of UTY would understand better how to contribute to the company's development and economic performance,
- strengthen the budgetary process, so that individual units would justify the need for resources on economically justifiable grounds, and would after approval be reasonably free to use the resources in the most effective way,
- improve joint work and communication between departments (joint work fosters communication and common sense of purpose),
- delegate authority and responsibility at appropriate levels, for well identified objectives, with appropriate controls,
- check on management performance, using specific reporting schedules and ad hoc audits, beyond
  compliance with administrative rules; possibly make economic performance a better mesure of
  performance than such compliance,
- make statistical information relevant for actual needs of the departments of UTY, and actually
  used for planning, decision making or performance measurement.

## Organisation and information system

An essential organisational principle that deserves to be applied more strongly within UTY is the appointment of a responsible person for any specific results that are considered as important to UTY.

This person may or may not be in charge of a department with heavy operational duties, but would participate in the decision making for any processes that have an impact on what he is responsible for.

An essential condition for such a principle to be effective is that the manager in charge would have all data available that are needed to monitor events and results in his fields of responsibility.

There are typically four dimensions along which responsibilities can be allocated:



- an activity or trade related dimension, grouping people along their technical skills or the intended technical result
- a hierarchy level dimension, providing keys for aggregation / desaggregation of units
- a geographical dimension, with admnistrative boundaries to be defined
- a product dimension, related to the many different services the railways can provide, internally or externally, and allowing costs, revenues and margins to be traced adequately

If the information systems are to be effective throughout multiple re-organisations of the company, it is essential that they would be able to deal simultaneously with all four dimensions.

## Adapting the accounting and Management Information Systems

Accounting and management information systems have been in place, conform to clear standards, and cover a wide spectrum of applications.

Historical information is available on that basis and on that basis only.

They therefore represent a very valuable asset for UTY; any change should as a result be evolutionary, and capitalise on existing practices, while introducing a new, more economic focus, and more integrated and comprehensive systems.

It the accounting schedules and principles have to be substantially modified, we would recommend changes to be gradual, and transitional accounts to be kept for, say, five years.

In implementing new systems, or adapting the existing systems, care should be taken to proceed gradually and systematically:

- 1 assess the appropriate level of detail for tracking activities, management levels, geographical locations and services,
- 2. define the relevant codification,
- 3. define the aggregation rules to be applied when moving from one level to the other.

#### Main F.A.M.A. functionalities proposed

The F.A.M.A. proposed should be include accounting, finance, economics and planning. It will be design for automation of following processes:

- general ledger,
- accounts payable and accounts receivable,
- fixed assets,
- inventory and procurment,
- finance and treasury,
- international settlements (multi-currency),
- management accounting,
- · financial planning,
- budgeting.



The system implemented should by design be able to cope with the four dimensions mentioned above.

It should be constructed in compliance with the general and specific economic regulatory framework in force in the Republic of Uzbekistan and with international accounting standards. It should also comply with UIC standards regarding such issues as costing of services.

### Management module

Managing a railways, means for each of the profit and service centres and any subset thereof:

- linking an approved level of expenditures to a scheduled production or level of activity, or to a set level of revenues,
- · controlling expenditures and outlays,
- setting production or revenue targets and checking on achievement.

All sub systems are needed, that contribute to setting realistic targets (using historical and other references), to follow the achievements compared to targets, to hint at significant deviations, and to update plans as needed, in order for the information systems to qualify as true "management information system".

At the present UTY have a Systra's "SysManagement" package designed to satisfy part of these requirements (goal setting, definition of standard costs). This tool was implemented by the TRACECA "Tariff and Timetable Structure" project and used the existing information. It is recommended to connect this tool with the futur F.A.M.A. to facilitate the tracking and summarizing of operating costs over time.

### 12.3.6.1.2 Personnel Management Application (P.M.A.)

It is highly recommended to implement a Personnel Management Application (personnel data base) to be organised into three levels: local, regional and national.

Main functions of the Personnel Management Application should be the following:

## Local Personnel Management Application

The local data base will insure main basic daily routine tasks, for instance:

- data acquisition of daily, weekly and monthly elements for the pay of employees,
- data acquisition of conventional items such as: (education / diploma, grade and function, adress, family composition and modifications, attribution of specefics benefits (clothes, free passes, etc), training, etc...).

## Regional Personnel Management Application

This base should agregate the most essential informations provided by local level. In addition, other modules should be integrated at the regional level such as:

- recruitments,
- changes in grade and jobs/functions decided at regional level,
- existing staff number agreed and existing for each unit (depots, sections, stations),
- affairs related to insurance funds and pension funds.



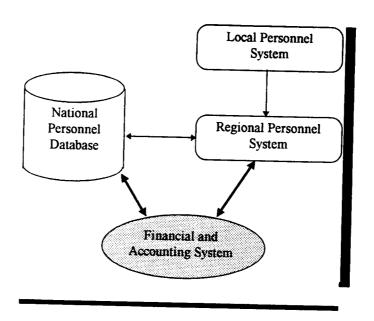
## National Personnel Management Application

The role of the national personnel data base is to consolidate regional informations to be used as a management tool for UTY: personnel statistics of any kind (grade, functions, age, location, ...). With the knowledge in real time of the personnel situation, it is easy for the Personnel Manager to take adequate decisions related to decide on personnel policy matters, particularly in managing the steering of staff downsizing and retraining.

In addition, at this level, another module related to Managers recruitment and career follow-up should be should be implemented.

Insurance and pension funds should be managed also at this level.

The architecture of the computerised personnel management system could be the following:



Personnel Management Application - Interfaces

## Advantages of a computerised Personnel Management Application:

It will allow UTY to:

- provide reliable personnel information and improve the quality of personnel management,
- centralize and control the information at Head Office level in order to take suitable decisions (which is not the case at the moment by lack of accurate information),
- regroup local centres for managing personnel which will allow a reduction in administrative staff by about 25 to 30 % when the system will be fully handled.

#### Option:

In order to improve the recruitment process, it is also proposed, as an option, to provide to personnel in charge a computerised tool (computerised tests) to recruit staff. The main functions are the following:

- · collation, numerical, verbal, arithmetical and abstract reasoning test,
- · concrete spatial test,
- perceptive test,
- syntactic verbal test,
- attention, supervision and performance test,
- psychomotor test.

### 12.3.6.2 Freight Marketing Management Application (F.M.M.A.)

This application follows external and internal objectives:

#### External objectives

- generate more detailed invoices, in accordance with established international practices,
- reduce the clients' administrative burden,
- open the system to outside clients and railways.

#### Internal objectives

- follow trends in the market (detailed statistics),
- reduce costs,
- improve the management tools and acquire a better understanding of costs and profitability by activity,
- foster decentralisation and decrease reaction time to information generated in the field,
- improve commercial documentation and automate its production,
- computer assisted preparation of contracts and shipping documents and automated circulation to interested parties,
- real time pricing, invoicing and accounting for entries directly related to the movement of freight.

#### Operating procedures

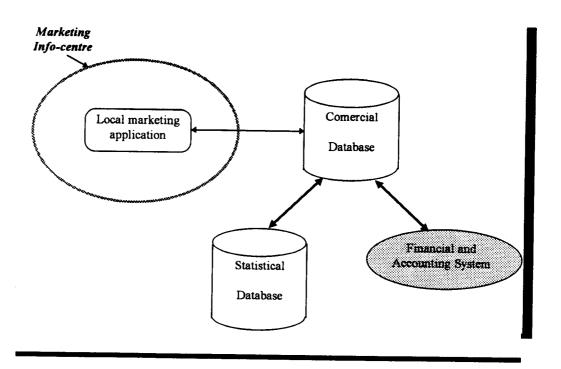
F.M.M.A. could be based on a shipments file, generated tentatively during commercial negotiations, confirmed at the signing of a contract, and fed with relevant information as the status of the contract changes, or as updates on the location of the shipment become available.

This file could be linked to a Commercial Data Base (C.D.B.) which would also include client related information, and allow shipment data to be consolidated on a customer basis.

It would typically have a client server architecture, with a central data repository, a local data repository for active shipments, allowing local operators to carry out most tasks without loading transmission lines nor the central processor, and, most importantly, without being dependant on the performance of the telecommunication lines.



A beta test could be organised quickly in Tashkent with a handful of the 40 freight forwarders dealing with UTY.



Freight Marketing Management Application - Interfaces

## 12.3.6.3 Infrastructure Management Application (I.M.A.)

For the Infrastructure Management Application the UTY needs a complete solution, including application software, available on the market, and adequate hardware and software architecture. The solution should be based on GIS, with adequate hardware for graphical workstations and servers.

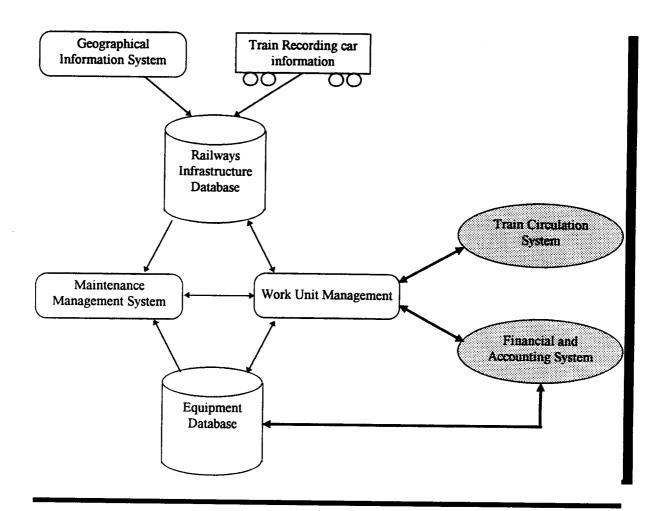
The main objective of the Infrastructure Management Application is to provide reliable information for the Infrastructure Business Sector, covering the infrastructure assets management, maintenance works management, resources, costs and investments control, projects control.

The application should provide informational support for the Infrastructure Business Sector activities, as a management and control instrument, in order to ensure its operational and financial autonomy.

The Infrastructure Management Application should have a modular structure, its modules being integrated through a client/server architecture and sharing a common railway infrastructure database.

The Infrastructure Management Application streamlines the business process by minimizing the paper flow process and performs electronic transactions in an efficient and practical manner for

maintenance and engineering activities. Management reports and enquiries will be provided to ensure independent operation and financial management of the Infrastructure Business Sector.



Infrastructure Management Application - Interfaces

## Geographical Railway Infrastructure Database Management

The Geographical Railway Infrastructure Database Management Module contains technical and administrative data, for all components of the Railway Infrastructure. Those databases will serve as the repository of data used in the Geographic Information System and the Railway Infrastructure Management.

The Geographical Railway Infrastructure Database Management module, built on GIS architecture, will ensure common data for all the infrastructure sub-sectors.

This module should be able to:

 hold survey legal and technical data for railway infrastructure components (Parcels, Buildings, Rail platform, Rail profile, Rail geometry, Construction and structural works, Bridges, Tunnels,



level crossings, track, switches, signaling installations, electrification installations, telecommunication installations, ...),

- hold financial data for railway patrimony,
- hold legal data for railway patrimony,
- · set up and maintain railway infrastructure maps,
- · restrict screen access to user sections and authorized personnel only,

- · convert survey data from the standard general survey data,
- · monitor access rights, by hierarchical levels,
- hold special information concerning circulation restrictions on each infrastructure element, ...

#### Train Recording Car

The Train Recording Cars provides all technical measure data. This study plans to invest in two of them.

#### Maintenance Management Module

The Railway Infrastructure and Equipment Management Databases should utilize Maintenance Management Module for support of infrastructure maintenance activities. This area represents the maintenance planning activities needed for all infrastructure components.

This module should be able to:

- define maintenance projects in detail (costs, location, facilities, resources),
- develop and update complete cost estimates for maintenance work projects,
- provide maintenance and repairs standards,
- amend categories of labor and activities codes, including current and middle term repairs and capital overhaul,
- track and analyze maintenance costs, by jobs, type, location,
- provide capability to hold information on the repair histories and maintenance cost,
- make the planning procurement of track steel materials (such as rails, switches, fastening, welding, etc.) sleepers, ballast, etc...
- provide capability to analyze and identify quantity, quality and types of used rails and switches for rail recycling process.

#### Work Unit Management

Once the maintenance activity has been planned, Work Unit Management should provide the Project Administration and Production Control needed to perform the maintenance.

The work unit management should support workshops activity scheduling and monitoring, local resources management, and work unit accounting.

This module should be able to:

- · set up and update information about work unit fixed assets,
- set up and update information about works in progress (costs, locations, facilities, resources),
- · develop and update work scheduling, resources allocation,
- manage local materials consumption and needs,
- track works in progress (both on technical and costs aspects), by infrastructure sub-sectors and their respective elements (track, bridge, tunnel, signal, switch, etc ...),
- update information about technical description and status of the infrastructure elements in its responsibility (track, bridges or signals, switches, etc ...),
- provide integration with the Financial and Accounting system for maintenance activities,
- provide integration with Train Circulation Monitoring for infrastructure utilization, including tonnage by section,



- provide integration with Equipment Management Module for equipment allocation and utilization,
- provide current reporting for the work in progress (status, costs, resources, equipment),
- provide reports (track, bridges and construction works quality status, installations technical status, electric power installations status, telecommunication and data transmission installations status, current and historical maintenance works, by infrastructure elements (track, bridge, tunnel, signal, switch, etc ...), equipment utilization and costs, ...)

#### **Equipment Management**

Equipment Management Module contains all technical data, maintenance requirements and maintenance history data for all equipment used in infrastructure maintenance or construction projects.

The Equipment Management Module should be established for equipment used in infrastructure maintenance or construction projects.

This module should be able to:

- set up and amend system reference data about infrastructure equipment inventory,
- set up, for each equipment type, technical data, financial data and utilization data,
- subgroup equipment by infrastructure sub-sectors (track, installation, telecommunication),
- track equipment use, by type, time, work unit, etc ...
- maintain equipment specifications,
- track equipment as an individual asset item and/or an as an item associated with other equipment,
- record the run hours and produce analysis/comparison of this data against budgeted utilization,
- use common reference masterfile with Work Unit Management module for equipment allocation and utilization report,
- provide integration with the Financial and Accounting system for equipment costs,
- maintain equipment activity and repair history,
- provide equipment utilization inquiry facility,
- produce equipment allocation statistics,
- provide detailed analysis of equipment use, costs, technical status,
- provide detailed analysis of movements in equipment inventory.

#### 12.3.6.4 Rolling Stock Management Application (R.S.M.A.)

For the Rolling Stock Management Application the UTY need a complete solution, including application software and adequate hardware. It should include, also Technical Documentation Management for the rolling stock.

The rolling-stock requirements include:

- Detailed information pertaining to all wagons and locomotives in active or passive fleets.
- Maintenance related activities for all rolling-stock assets.
- Store and stock control functions required in the maintenance units.
- Management of all rolling-stock technical documents.

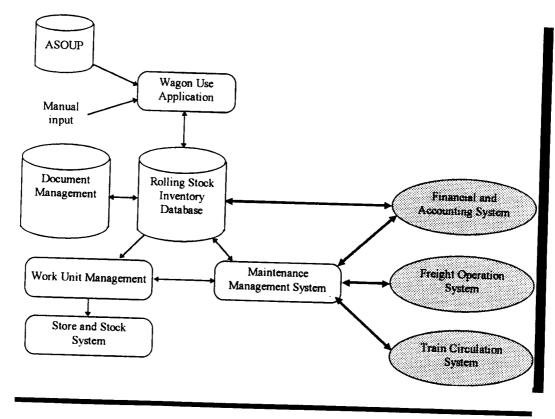


- The purpose of the Rolling-Stock Management Application is to provide:
  - reliable information across the organization covering the existing wagon and locomotive fleets.
  - railway rolling-stock investments,
  - resources allocation and utilization,
  - maintenance activity.
- Rolling-stock database management.
- Cost control and documents management.

The R.S.M.A. should provide the following modules:

- rolling stock inventory database management,
- maintenance management,
- store and ctock control,
- rolling stock technical documentation management,
- work wagon module.

All the modules should share a common rolling stock inventory database.



Rolling-Stock Management Application - Interfaces

### Rolling-Stock Inventory Database Management

The Rolling-Stock Inventory Database Management module should store data containing financial, technical, and historical data about each rolling-stock element for all wagons and locomotives in active or passive fleets.

This module should be able to:

- set up and update a rolling-stock element, by code, type, vendor, construction year,
- set up and update information about financial characteristics of the rolling-stock element (initial value, liquidities, maintenance expenditures),
- set up and update information about technical characteristics of the rolling-stock element, with component limits for maintenance,
- set up and update information about the day-to-day activity of the rolling-stock element (current operation, repairs, lend),
- hold historical data about each rolling-stock element, for its entire life cycle.

#### Maintenance Management

The Maintenance Management module should provide support for the rolling-stock maintenance activities, both for wagon and locomotive sub-sectors, from the top management level down to the work units.

This module should be able to:

- set up and update the rolling-stock inventory database,
- · develop, update, track and analyze cost for maintenance works,
- provide maintenance and repairs standards and part exchange methodology, both for wagons and locomotives,
- provide capability to amend categories of labor and activities codes,
- provide capability monitor the rolling-stock fleet which is in the work unit responsibility,
- provide assistance in elaboration of the operational plan for rolling-stock, based on all necessary planning data for maintenance and operation of each rolling-stock unit (locomotives, freight wagons, passenger coaches, etc ...),
- develop yearly/monthly/daily maintenance plans, at work unit level, centralize them to regional and central levels, analyze and distribute revised plans and work orders,
- provide capability to track maintenance works and compare their performance against plan,
- provide capability to hold information on the repair histories and maintenance costs, by work unit.



#### Store and Stock Control

The Store and Stock Control should be used for the stock management in the maintenance units stores. It should share a common stock item/vendor database with other modules: purchase order processing and accounts payable from the financial and accounting system.

This module should be able to:

- set up a reference data,
- input stock movements and stock adjustments,
- track material receipts to related purchase orders,
- track material issues and returns to cost centers, activities and work orders,
- group items of stock based on the stock item coding structure,
- maintain the multiple cost of each stock item and value stock item balances based on weighted average cost,
- charge external work orders, for materials issued,
- reconcile materials received to purchase orders,
- · record and track discrepancies in material received,
- maintain, for each stock item, inventory control information,
- provide facility to obtain stock item details by multiple data elements.

#### **Document Management**

The Document Management module should be used for all the rolling-stock technical documentation. The data should be concentrated in a central database with possibilities to transfer a document, at request, to a regional server. The updating of documents should be the responsibility of the central office.

This module should be able to:

- hold documents profile data,
- hold all drafts related to a rolling-stock element (wagon, locomotive),
- manage the document work-flow,
- set up and maintain document versions,
- hold different document formats.

#### Wagon Use Module (W.U.M.)

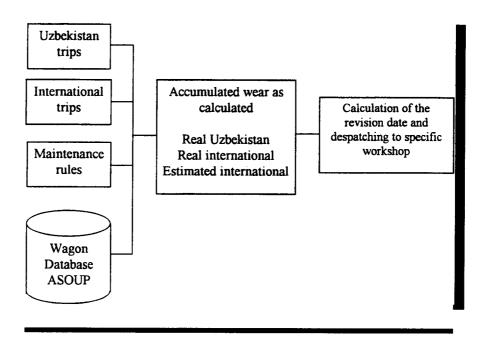
W.U.M. would allow UTY to schedule repair and maintenance works on wagons according to the time they were effectively used, as opposed to time lapsed since the last time in the workshop. This could generate substantial savings, and possibly also a better security and reliability.

ASOUP can deliver the needed data.



Running time for national wagons crossing the national border may be either

- estimated from time away, using conversion tables to be drawn up, or
- communicated by the partner railways which would operate according to the same principles Specific algorithms could then help scheduling workshop interventions.



Wagon Use Application - Calculations

The W.U.A. should consist of:

- wagon technical management database containing all technical data, being structural or status related (live information)
- statistical or historic information could be archived separately

Data consistency is a critical requirement.

#### 12.3.6.5 Train Circulation Monitoring Application (T.C.M.A.)

The Train Circulation Monitoring Application should be constituted on the three following modules:

#### 12.3.6.5.1 Computer aided-design of timetable

In order to guarantee efficient management of the railway traffic, it is necessary to study the timetables, the times of departure and arrival, the passing times, the stopping times in stations, so that all the trains run harmoniously, without coming up against signals set at danger and in compliance with signalling rules.

The purpose of the module for computer-aided design of timetables is to enable the timetable engineers to:



- study the consequences of any modification in the infrastructure or in the performance levels of the rolling stock,
- adapt a transport programme on the basis of a new study,
- calculate standard runnings for the various train categories,
- detect and examine the consequences of the different types of signals on a given transport programme,
- identify various possibilities.

The timetable design software should be a programme running on a micro-computer with which the operator, the timetable engineer will dialogue via the screen.

This tool, it should be possible to:

- display the space time diagram showing all the trains and the train under consideration,
- examine the interferences with other trains,
- take into account the modifications entered by the timetable designer and help him solve the problems thus generated.

The computer aided-design of timetable should have a modular structure, its modules sharing data with the Infrastructure Management Application regarding the circulation conditions and resources.

Most importantly, the tool can be used by the dispatching center to adapt to unanticipated circumstances.

#### 12.3.6.5.2 Computer aided-design of rosters

Management of railway rolling stock is optimised by the use of rosters.

The purpose of making rosters is to obtain the best possible utilisation of rolling stock.

A roster is the graphic representation of the way how locomotives haul trains in succession to serve mainly a given area for a certain period. Trains are planned according to certain criteria in roster days. A roster day is a number of trains which can be hauled by one locomotive.

Computer-aided design of rosters linking the roster offices and the operating centres from the data processing viewpoints.

The software should design to carry out the following tasks, for the duration of a seasonal schedule:

- assist with the design and setting up of the theoretical rosters (locomotives and staff),
- help implementing the technical means to enable local staff to modify rosters designed by central staff, in case of changing conditions, or even to set them up themselves,
- using near optimum economic conditions archived in a special purpose library, and thus easily fall back on optimum conditions even when adaptations are requested by the users.

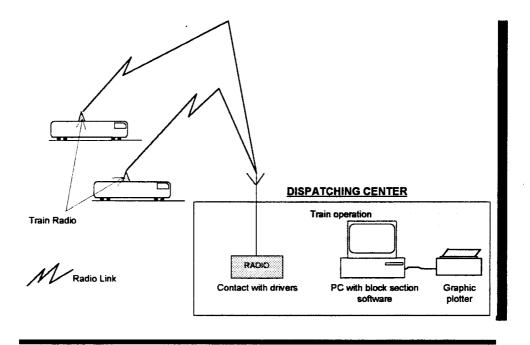
Computerising roster design aims at:

- reducing the time required for building up a roster by automating the process, and eliminating all
  controls because internal consistency and consistency with all known data about trains planned,
  are built in.
- ensuring graphic display for more convenient use.

#### 12.3.6.5.3 Control of train operation using computer systems and radio links

On most lines, transmission of information between the train crew and the dispatcher would keep using radio links.

The dispatcher could make an effective use of modern software for the follow up of trains and track sections. Critical situations would then be assessed by the computer, using information input by dispatcher, on the basis of what is transmitted orally by the train crew. Track occupancy could be displayed on a computer screen.



#### 12.3.7 Telecommunication infrastructure

The opportunity or the need for new infrastructure is obvious. What should be renewed, and for which amount is another matter. In 1995, UTY have made a telecommunication reconstruction study detailing needs for the whole railway. The total cost is estimated by UTY at about 55 million USD and 128 million Sums until 2010. It includes a full renovation, including modern, digital fiber transmission lines.

The first contract signed under this plan was signed with Ericsson, for 1,7M\$ for new PABXs; only the Termez exchange (2000 lines) was installed, in line with the funding that was made available.



UzbekTelecom has also come up with a national plan of installation of digital fiber optic transmission lines, to be implemented till 2005. Works have started, and cable is being laid alongside the main road between Tashkenet and Bukhara.

No provision has been made to merge the two plans, nor to have one of the two companies to use the other's new infrastructure. It can be argued that UTY's infrastructure would be significantly underused; furthermore, it may be difficult to sell capacity to outsiders, with the possible exception of mobile phone operators.

The main argument in favour of the redundancy is security: if an accident would damage the line alongside the main road, UTY infrastructure could provide a back up. This possibility would however require additional invesment. Finally, the following question remains unsolved: why would UzbekTelecom not use the railway track instead of the roadside, much more prone to damages (intersections!).

Furthermore, it can be argued that UTY can take advantage of three important factors in planning for the future:

- the right of way covers all significant parts of the country; cable of any technology can be inexpensively laid alongside the track, and be used with excellent security,
- most of the existing infrastructure is abslutely obsolete, and UTY need not make any
  compromise in making technical decisions for the future, thereby selecting the most suitable
  technologies,
- the sheer size of their needs allows UTY to implement medium or large scal systems by themselves, or to negotiate with strategic partners.

The first of these will be addressed in the part of this study carried out by UIC.

This present study can not result in final technical choices; it can however result in timing and sizing the required investment.

Conversely, it can be argued that UTY are under no time pressure to upgrade their communication infrastructure; careful planning and implementation will have a profound impact on cost and timing of the cash flows.

Technical choices must be made regarding transmission systems across the country and within buildings: fiber optics technology, coaxial or twisted pair, depending on expected volumes and actual use.

These must also be made regarding the actual functions that the systems will be expected to implement (voice, data, possibly video), and the networking technologies (telephone exchanges, inter-/intranet, LAN / WAN, ...).

For instance, the choice of high performance digital exchange technology removes much of the need for traditional computer networking, with added flexibility and evolutivity.

Nevertheless, reference is made to the Infrastructure Maintenance 2 TACIS project in assessing the condition of the equipment. The conclusions of that report are set out as follow:

- As an emergency measure for day to day telecommunication maintenance, it is important to invest approx. 500,000 USD minimum.



- Remplacement of transmission backbone for TRACECA corridor (open wire by optical cable
  for long distance, including all digital multiplex and power supply equipement with batteries, and
  copper cable for permanent way distribution):
  - . Installation of 732km of optical cable and 450 km of copper for permanent way distribution:

10,400,000 US\$

- Remplacement of operating telephones (dispatcher):
  - . remplacement of 40 station operator consoles and 3 main dsipatching system concetrators:

450,000 US\$

- Remplacement of radio equipment:
  - . remplacement of 40 fixed base radio and 20 on-board equipment for train/dispatcher radio system:
  - . remplacement of 20 fixed base radios and 50 hand held radios for shunting radio system:

760,000 US\$

- Remplacement of administrative telephones (PABX):
  - . 1 PABX of 6500 lines, 4 PABX of 500 to 1000 lines, 1 PABX of 1000 to 2000 lines and telephones sets, distibutions cables and connectors:

    2,700,000 US\$

Uzbekistan needs to update his telecommunication network. UzbekTelecom plans to install a new optic fiber network in the country. UTY can negociate with UzbekTelecom the installation of a new optical cable network.

# 12.3.8 Project and trainning requirements

For all the supplier should request to quote for all the following items (products and services):

- · definition of the solution,
- · project management,
- · application software packages, being in operation at a transport company,
- · hardware and system software for the Solution provided,
- · database Management System Software,
- · training of Informtion Technologie (IT) people and of application users,
- implementation of the application at the places agreed with UTY.

12.3.9



#### 12.3.10 M.I.S. Investment Plan

The M.I.S. investment plan does not include the telecommunications.

The hardware estimated unit costs square with the Uzbekistan prices. Consulting fees are at market rates. The local experts are not included.

#### **Hardware investment:**

HARDWARE		Qty	Unit cost (US\$)	Cost (US\$)	Total cost (US\$)
Operating PC	PC	2 800	1 500	4 200 000	
	LAN 1	200	5 000	1 000 000	••••••
	LAN 2	12	6 000	72 000	5 272 000
Head offices	PC	400	1 500	600 000	
	LAN 3	16	8 000	128 000	•••••
	LAN 4	7	10 000	70 000	798 000
F.A.M.A.	PC	500	1 500	750 000	
	LAN 1	20	5 000	100 000	~~~
	LAN 2	30	6 000	180 000	1 030 000
Printers		1 000	500	500 000	500 000
Network		1	1 500 000	1 500 000	1 500 000
Teletyping		150	500	75 000	75 000
				Total	9 175 000

LAN 1 - up to 10 workstations,

LAN 2 - 10-50 workstations,

LAN 3 - 50 - 200 workstations,

LAN 4 - 200 - 600 workstations,

PC - working station is a personal computer of Pentium 166 MHz-type, a modem and/or network map, UPS at the average price of \$1,500.

Depending on architecture choices made by UTY regarding applications and telecommunications, the budget for servers could be shifted to accommodate larger departmental or central units.

#### **Software investment:**

SOFTWARE	Qty	Unit	cost	Sub-Total cost (US\$)	Total cost (US\$)
Project Management					
Consultant	30	35 000	USD/m.	1 050 000	1 050 000
Finance and Accounting Management Ap	plicati	on			
Software	1	300 000	USD/lic.	300 000	
Implementation - Training	8	27 000	USD/m.	216 000	516 000
Personnel Management Application					
Software	1	100 000	USD/lic.	100 000	
Implementation - Training	8	27 000	USD/m.	216 000	316 000
Marketing Management Application					
Software	1	300 000	USD/lic.	300 000	
Implementation - Training	5	27 000	USD/m.	135 000	435 000
Infrastructure Management Application					
Software	1	250 000	USD/lic.	250 000	
Implementation - Training	4	27 000	USD/m.	108 000	358 000
Rolling Stock Management Application					
Software	1	550 000	USD/lic.	550 000	
Implementation - Training	6	27 000	USD/m.	162 000	712 000
Train Circulation Management Application	n				
Software	1	500 000	USD/lic.	500 000	
Implementation - Training	4	27 000	USD/m.	108 000	608 000
Systems specifications and design	1	900 000	USD	900 000	900 000
Program development and testing	1	700 000	USD	700 000	700 000
			:		5 595 000

# M.I.S. Investment Plan for the first five years:

Item		Year 1 (US\$)	Year 2 (US\$)	Year 3 (US\$)	Year 4		, ,
Hardware		, , /	1 (3-3)	(334)	1 (033)	(US\$)	(US\$)
Operating	PC	1 260 000	2 100 00				
	LAN 1	300 000	· · · · · · · · · · · · · · · · · · ·		-1	<b>-</b>	4 200 00
	LAN 2	21 600				.  -	1 000 000
Head offices	PC	180 000				<u> </u>	72 000
	LAN 3	38 400	1			-	600 000
	LAN 4	21 000				· -	128 000
F.A.M.A.	PC	225 000		1 000			70 000
	LAN 1	30 000				ļ <b>.</b>	750 000
*	LAN 2	54 000			1	•	100 000
Printers					<u> </u>	-	180 000
Network		150 000		1	-	-	500 000
Teletyping		75 000		300 000	<u> </u>	<u> </u>	1 500 000
	Sub-Total			-		-	75 000
Software		2 999 000	4 500 000	1 720 000	0	0	9 175 000
	Manage						
Overall Project Management		210 000	210 000	210 000	210 000	210 000	1 050 000
Finance and Accounting Management Application Personnel Management Application		258 000	154 800	103 200		-	516 000
Aarketing Man	agement Application	221 200	94 800	-	-	-	316 000
ofractructure M	agement Application	87 000	217 500	130 500	-		435 000
Colling Stock M	anagement Application	35 800	143 200	143 200	35 800		358 000
rain Circulation	anagement Application			213 600	284 800	213 600	712 000
vetere energie	n Management Application		•	182 400	304 000	121 600	608 000
Systems specifications and design System integration and testing		500 000	200 000	200 000	-	-	900 000
yaem megrat	ion and testing	-	250 000	150 000	100 000	200 000	700 000
ther (5 %)	Sub-Total	1 312 000	1 270 300	1 332 900			5 595 000
Market and the second s		213 350	288 515	152 645	46 730	37 260	738 500
Grand Totals		4 480 380	088 815	3 205 645	901 330	782.680	
		29%	39%	21%	6%	5%	100%

The M.I.S. investment plan is estimated to cost about US\$ 16 million.

12.3.11

#### 12.3.12 Benefits expected from the proposed investments

#### 12.3.12.1 General considerations

The rate of return from a computer system varies tremendously across the spectrum of applications and the rationale involved for the implementation of the renovation:

- · accounting,
- · management,
- operations (and further depending on circumstances),
- computerisation of previously manual processes,
- improvement of existing processes,
- replacement of obsolete systems.

Benefits can be ordered into three broad classes:

#### 1. Direct savings:

- . labour, related costs (office, space,...), related to automation or integration
- (avoided) increasing maintenance expenditures for obsolete applications.

#### 2. Indirect or induced benefits:

- . quality improvements; potentially quite large for M.I.S. type applications,
- operational savings (... shorter routes, better utilisation rate), and maintenance related savings (less breakdowns, better energy efficiency), to be split between lower operating costs and lower capital requirements; these benefits could be translated directly into class 1 savings for the purpose of calculating rates of return,
- better managerial decisions owing for instance to better knowledge of costs (better pricing, better capital allocation decisions, ...).

#### 3. Intangibles:

Some projects or investments do actually impact attitudes and expectations of people in a profound way; such changes may be crucial for the success of the undertaking as a whole.

Image building is a deciding parameter for any enterprise undergoing profound changes: towards customers, and also towards employees.

Customers may only come if they have the proper confidence in the supplier deliverering the agreed upon services; they may also only be willing to pay the price expected for the base service or for the value added services if the image of the suppliers right.

Highly qualified engineers and managers will only join if they feel that the job is interesting, will lead to results, and that the image of their new employer will enhance their own image and their careeer. This is particularly true if the salary levels are not too generous, as is currently the case for UTY.

Breaking away from past practices and past image may be a decising factor for the success of UTY restructuring.

In practice, each application yields benefits in each of the three classes; making choice a matter of judgement as much as a matter of measurement.

In a modern enterprise, even more so in one operating in a stable environment, typically most class 2 and class 3 benefits have been taken advantage of; investment is justified mostly by class 1 arguments and figures.

In an enterprise facing difficult managerial and business changes, even more so in a low or moderate wages country, class 1 benefits would be typically comparatively much lower.

Reduction in payroll related expenses would in any case be moderate, and may not justify the social unrest created by hastily implemented redundancies. It is worth noting that payroll is only in the order of 20% of total costs; much more significant gains must be achieved elsewhere first.

Investment control (including expenses for major overhaul of rolling stock and permanent way), operational efficiences, and customer satisfaction leading to improving market share or higher prices, hide much more significant stakes.

#### 12.3.12.2 Estimation of benefits derived from recommended investments

The major benefits expected derive from improved management practices, leading to a better control of the above mentioned stakes, and savings to be measured as a proportion of the life cycle costs of the related assets.

Application	Benefits			
F.A.M.A. (Financial and Accounting Management Application)	<ul> <li>increased relevance and precision of financial information, for accounting purposes, and for the delivery of economic data for decision making purposes,</li> <li>ability to implement budgeting process effectively, for running costs and for capital expenditures,</li> <li>centralised and automated bookkeeping, leading eventually to savings in manpower in bookeeping departments estimated between 30 and 35%; also leading to improved controls, that are needed for decentralisation of decision making.</li> </ul>			
P.M.A. (Personnel Management Application)	<ul> <li>provide reliable, up-to-date and comprehensive personnel information,</li> <li>improve the ability of head office and departments to effectively make staffing and training decisions,</li> <li>centralised and automated recordkeeping, leading eventually to savings in manpower in personnel departments estimated between 20 and 30%; also leading to improved controls, that are needed for decentralisation of decision making.</li> </ul>			

Application	Benefits
F.M.M.A.	• follow trends in the market (detailed statistics) so as to adapt capacity on scheduled service, and to better define the service needed,
Freight Marketing Management Application	• reduce administrative costs (making price quotations, finalising contracts, despatching of contracts, shipping documents, and related operating instructions, invoicing, automated related accounting entries),
	acquire a better understanding of costs and profitability by activity,
	• foster decentralisation and speed up decision making by headquarters upon request from the field,
	• improve commercial documentation (precision, ergonomy) and automate its production.
I.M.A. Infrastructure Management Application	• increased relevance of maintenance and repair operations actually carried out, and increased effectiveness of maintenance policy, possibly leading to savings in overall maintenance costs of 20% for a given level of availability of the infrastructure,
	• computerised planning and control helps ensure that scheduled operations are really carried out, leading to a more effective maintenance,
	<ul> <li>automation of information flows leads to reduction in needed administrative staff (possibly 5% of total staff).</li> </ul>
R.S.M.A.	• availability driven maintenance policy allows a streamlining of human and
Rolling Stock Management Application	material resources needed to achieve a given level of availability of units, sub assemblies and components, possibly leading to very substantial savings in maintenance expenditures (30%?), a more reliable availability of the fleet, and the related need for a smaller size fleet of rolling stock.
T.C.M.A.  Train Circulation	• improved design and setting up of the theoretical rosters (locomotives and staff), leading to better productivity and utilisation rates (5 to 15%),
Management Application	• improved adaptation to changing circumstances, leading to better quality of service (time relaibility), and marginally better efficiencies (reduced re-routing and waiting times for staff and rolling stock).

It is estimated that modern management information systems would generate savings of a minimum of 20% of the expenses associated with the cost of maintaining the infrastructure and rolling stock. This equates to million US\$ per year. Depending on sub systems, the investment would be returned in a few months after successful implementation.

A quick return on investment is expected from all systems directly impacting on operations, i.e. all systems but the financial and human resources systems. In effect, the stakes handled are a considerable multiple of the investment required, and these systems immediately and visibly improve economic efficiency.

This alone would plead for a priority implementation of these systems, possibly at the expense of financial and human resources ones.

This approach may however be misleading, as the actual capture of the expected benefits, and the related monitoring by top management and the regulatory body do actually require:



- the right people with the right training in the right place, reporting adequately on needs and achievements; the training and deployment of managers with the appropriate skills is a difficult and time critical activity, which actually conditions the whole change process at the railway,
- that the whole process be actually integrated in an effective budgetary and reporting process; failing this, there is more than a strong chance that managers could not be held accountable for the expected benefits, and that individual benefits expected from individual systems would not add up to tangible economic benefits for the railway.

We would therefore recommend that the financial and human resources systems would be implemented in priority, possibly bundled with other systems, so that reporting systems would be tightly integrated.

#### 12.3.13 Conclusion

The Tashkent processing center was asked by management to implement a new information system. At this time the focus is laid on improving existing applications. There is an opportunity to re-think the information system according to the new needs of users, and making the best possible use of the existing technology.

It can be argued that many management processes could be computerised at UTY.

Information systems	Existing	Comments
<b>F.I.A.</b> (Freight Information Application)	Yes	ASOUP system could be used another 5 years without high investment.
F.M.M.A. (Freight Marketing Management Application)	No	This system is proposed in this study.
W.U.A. (Wagon Use Application)	No	This system is proposed in this study.
P.M.S. (Passenger Management System)	Yes	EXPRESS 2 system could be used another 5 years without high investment. The Russian developer will release some time in the future version 3.0; financial estimates are not readily available.
F.A.M.A. (Financial and Accounting Management Application)	No	This system is proposed in this study.
P.M.A. (Personnel Management Application)	No	This system is proposed in this study.
S.S.S. (Store and Stock System)	No	This system is proposed in this study.
I.M.A. (Infrastructure Maintenance Application)	No	This system is proposed in this study.
R.S.M.A. (Rolling Stock Maintenance Application)	No	This system is proposed in this study.

Information systems	Existing	Comments
T.C.M.A. (Train Circulation Management Application) - Design of timetables - Design of rosters - Control of train operation	No	This system is proposed in this study.

Computerisation is however only part of the picture; remodeling management processes, in order to ensure that MIS will support company strategy and allow management to make the economically and operationnally right decisions, is an abolute prerequisite.

Therefore, the focus for the remainder of this assignment will be laid on prioritizing and putting into perspective the need for implementing computer software, hence allowing rough scheduling, sizing and technical definition of future related investment. It should however fall short of a full fledged computerisation master plan.

It should be noted that the applications proposed here purpose to improve management processes internally; they do not impact information exchange with other CIS countries. Even application like ASOUP, EXPRESS2 and others, which do exchange data with other CIS countries may be modified however, without any adverse consequences, to the extent that the standards for information exchange are met, which have been defined by OSZhD.

#### Main items:

- First, absolute priority is the implementation of the Finance and Accounting Management System and Personnel Management System.
- Second, equally important and quite urgent:
   Maintenance Management (Infrastructure and Rolling Stock, distinct applications),
   Marketing Management,
   Train Circulation.
- Third, equally important but not urgent (not included in the investment plan):
  Freight Information System (successor to ASOUP)
  Passenger Information System (successor to EXPRESS 2). The Russian developer will release some time in the future version 3.0; financial estimates are not readily available.

The M.I.S. investment plan is estimated to cost about US\$ 16 million.

It is estimated that modern management information systems would generate savings of a minimum of 20% of the expenses associated with the cost of maintaining the infrastructure and rolling stock. Depending on sub systems, the investment would be returned in a few months after successful implementation.

Telecommunications are based on Soviet technology. Today no technical study does exist to justify the implementation of fiber optics cable rather than another medium. UTY needs a specific study to know the existing telecommunication situation and to define the requirements of an efficient telecommunication system (module E?).

Uzbekistan needs to update their telecommunication network. UzbekTelecom (UT) plans to install a new optic fiber network in the country. An interesting solution is to negociate with UT the installation of a fiber optics cable in some sections or lines of the railways when there is an obvious invesment need. Conversely, where UT has available capacity with modern technology, using this capacity may be considered by UTY.



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**ANNEXE 1 - QUESTIONNAIRE** 

ANNEXE 2 - SAMPLES SYLLABI



### 13. Human Resources Report

This section comprises the report of the Human Resources Expert on the team and reflects the information gathered during two visits to Uzbekistan. These visits were from the 9th to the 23rd of September and from the 13th to the 29th October, 1997.

#### 13.1 General

In establishing the context for this section of this report it is necessary to look at the environment in which this restructuring of UTY is happening. There have been several previous reports which dealt with some or many of the issues involved with restructuring, most recently the study conducted by PADECO on behalf of the Asian Development Bank, which was completed during the early stages of our study. It is not intended, within the human resources report to revisit the issues already covered by previous efforts other than, perhaps, to comment on areas where clarification is required. Rather it is the intent of this report to concentrate on a number of strategic issues which can help establish the framework to allow Uzbekistan Railways to manage the human dimension of any future restructuring. This will be covered in four major issues.

#### The issues are:

- the down-sizing which will be required in order to make Uzbekistan Railways (UTY)
  capable of functioning as a commercial, restructured entity and the manner through which
  this will be achieved
- the way in which UTY will divest itself of non-core activities (particularly the social obligations it currently discharges) so as to allow it to operate commercially
- the training needs which will grow out of the new commercial imperative how these needs can be assessed and satisfied and
- the information requirements and procedures which will be necessary to allow UTY to manage its human resources in a manner which supports the business objectives

#### 13.2 Downsizing

The issue of downsizing is, potentially, one of the most sensitive areas within the entire restructuring process. Staff, at all levels, will feel threatened and uncertainty, with its attendant rumour machine, will be rife. The most effective way to deal with this is to develop a clear strategy which all staff know and understand, to articulate the processes which will be employed to achieve the strategy and to ensure that the process are seen to be transparent and equitable.



Much has already been written in previous reports about the need for UTY to downsize to a level where the core business can be effectively serviced. Figures have been suggested (e.g. from 51,943 to 35,304 in the PADECO report) but these figures have not been fully justified. It is not the intention of this document to revisit those figures but, rather, to attempt to highlight those issues which are of strategic importance in identifying and managing the transition to the new organisational structure.

The sequence of events for any restructuring, and subsequent downsizing initiative, should, ideally, follow the pattern of:

- 1. a clear definition of the relationship between the Government of Uzbekistan and Uzbek Temir Ullari (UTY) in the context of ownership of assets, social responsibility and commercial freedoms
- 2. a definition of the commercial objectives of UTY and the performance measurements by which the achievements will be monitored
- 3. a decision on the form and type of organisation which can best deliver the business objectives of UTY
- 4. an analysis of the staffing levels best suited to the achievement of the objectives
- 5. an analysis of the skills or competencies (managerial, technical and commercial) needed
- 6. an assessment of the level of these identified skills within the existing staff
- 7. the adoption of a selection process which takes account of existing skills levels, potential for development, length and likelihood of tenure and degree of "cultural fit" with the new organisation
- 8 the development of a coherent company-wide training and development plan to bring the skills levels into line with current and future requirements
- 9. the development of plans to deal with those current staff members who will not be required within the new organisation

#### Item 1

is currently being developed within the framework of the restructuring committee and with the assistance of the current project.

#### Item 2

is, effectively, the foundation on which the remaining steps should be based. We are not aware of any initiatives to articulate this dimension, particularly in a formal way such as a contract between the stakeholders (at the moment, the Government) and the railway.



#### Item 3

has already been the subject of discussion between members of the project team and Mr Kadirov's team. The final shape of the organisation has yet to be agreed but there seems to be broad agreement on the outline shape for the future. The concept of separate organisations for passenger and freight traffics, together with organisations for infrastructure and rolling stock seems to have general agreement, with just the detail concerning corporate and ancillary services remaining to be determined. There appears to be, among the senior management with whom we have spoken, unanimous agreement that existing staff levels are too high and that the process of downsizing, which has already been started, must be continued until acceptable levels are reached. Where there does not appear to be agreement, however, is in the methodologies which should be employed to achieve this.

It is worthwhile, at this stage, to make some general points about the change process itself and some of the difficulties which can arise in the implementation of change.

A change of the magnitude envisaged for UTY will, inevitably, take a long time and meet with considerable resistance. In many cases, often because of outside pressures, both of these factors are either ignored or given less prominence than they should have. Timescales are imposed by external agencies who either do not, or choose not to, recognise the enormity of the task facing those charged with its implementation.

It should be recognised that resistance to the implementation can be based on a wide variety of factors. These would include, fear of the unknown, lack of information, misinformation, threat to status, threat to power base, fear of failure and reluctance to experiment. All efforts should be made to identify the reasons for resistance so that strategies can be put in place to overcome them.

To help facilitate the change process, one of the most important tools is communication. If people are made aware of the reasons for change, the implications of the change and how the changes will impinge on them personally, they are far more likely to commit to its success. Mechanisms must be developed which allow staff members opportunities to express opinions and feelings they may have towards the proposed changes.

Decisions must also be made as to the best mechanism for implementing the change. If a direct changeover approach is used, then people are at least sure of precisely what is happening, and the whole organisation is involved. However, a direct changeover is always risky, because without prior testing it is difficult to be sure of the success of any new system. An alternative would be to introduce parallel running, where a new system can be seen to be operating effectively before terminating the old one. However, it is both labour and resource intensive and can lead to possible confusion. These are only two of the possible approaches to change. What is of critical importance is that the system chosen is appropriate for both the task and the culture.

### 13.3 Social obligations

UTY is very much an ideal employer in the sense that it provides an extensive and sophisticated welfare scheme for its employees. Housing is provided for many employees, an extensive - and highly regarded - health care system is in place and a comprehensive educational system exists for the children of the employees.

All of these activities generate a substantial revenue charge in the railway which none of its competitors have to face.

It is highly probable that the re-organisation and restructuring which is envisaged will generate considerable redundancies. This, in turn, will create an additional financial burden the railways. But this is not, however, the only parameter to be taken into account in this equation. It is important to minimise the negative impact that change will have on all the staff, both those who remain and those who are to be made redundant. Studies have shown that the way in which redundant employees are treated has a significant impact on the morale of those who are left and on the way in which they perceive the organisation. In the context of UTY it was notable that in conversations during the human resources experts visit (particularly with senior officials in both the personnel department and trade union) a commonly expressed fear was that the quality of the medical services would significantly disimprove should they cease to be operated by the Railways.

A mechanism therefore must be found which addresses these conflicting needs. The consultants recommend that a restructuring agency should be established. This agency would undertake a number of functions.

- The absorption of redundant rail workers
- the re-training of redundant staff
- the out placement of redundant staff
- the management of the medical facilities
- the management of the educational facilities
- the management of the housing facilities
- the absorption of any outstanding capital railway debts

As mentioned in the section on downsizing it is important that there is a clear understanding of the staffing levels required to carry out the business objectives of the railway. Simply to leave those people not required in the new structure in place until natural attrition brings the staffing levels to the required point would be detrimental both to the establishment of the new commercially focused ethos and to the morale of the staff charged with the achievement of the business objectives.

The first three functions outlined above for the restructuring agency are closely interwoven. The agency would become the employing department for all redundant rail workers. The staff within the agency would need to carry out a detailed analysis of the labour market within Uzbekistan and develop training programmes in which the redundant rail workers could acquire skills which would make them employable in the open market. If this were done successfully then the restructuring agency would become known as a good source of highly skilled labour from which employers could draw. This would make the achievement of the third function, the out placement of staff, considerably easier.

In terms of managing the medical facilities a decision must be taken at Government level as to whether these facilities should form part of the medical infrastructure for the country or whether they are, in fact, surplus to demand. It is perhaps worthy of note that when the railway in Khazakstan transferred forty two hospitals to local authorities thirty six were closed the following day because the municipalities had no money to run the services. It would seem preferable therefore that the Government would manage the medical facilities to attempt to maintain the level of service currently being offered to rail workers. In the longer term it may be necessary to establish a medical insurance fund as a subsidiary of the national medical insurance fund. This could be funded through a monthly deduction from payroll and would insure that the staff remaining within the railways who contribute to this fund would be able to avail of free medical care in the case of acute illness. The Government would still be charged with caring for chronic illness.

Equally with the management of educational facilities the government decision must be taken as to whether they see the existing facilities fitting into the educational infrastructure or whether these are deemed to be surplus to requirements. Any decision within this area will of necessity have both an economic and social dimension.

In terms of managing the housing facilities in the longer term this is perhaps not an area with which either the railway or the restructuring agency should be involved. A suggested mechanism for minimising the impact of this particular function would be to offer the housing to the existing tenants at a commercial rate. This rate could be discounted in accordance with the number of years service to the point that, for example, somebody with, twenty years service would pay perhaps only 10% of the market value for the particular property. While this might, ultimately, lead to the involvement of speculators it should, at least in the short term benefit the employees and remove a significant burden from the railway or restructuring agency.

All of these activities will cost money. In order to, at least partially, offset the expenditure it is suggested that the railway pass ownership of any surplus railway property to the restructuring agency. The agency would then create a small property management unit which would seek ways to maximum the commercial potential for this property.

The profits realised through such endeavours would not of themselves completely fund the initiatives described however, they would go some way towards alleviating the financial burden on the Government.

13.4



## Training needs

In moving UTY towards its new commercial orientation it is very likely that some skill sets which do not yet exist will have to be developed. These skill sets will encompass a range of activities but will be in the professional/technical area (e.g. financial management marketing etc.) and in the area of management itself.

The first stage is to identify the duties and responsibilities which will exist for each position within the structure, to identify and prioritise the most important of these and to clearly define the competancies or skills sets which will be needed to discharge these duties. This should firstly be developed for the key positions in the new organisation following which an evaluation must be undertaken of the people who fill, or are likely to fill, these positions. In undertaking this evaluation the people will be measured against the competencies already defined for the position. The difference between the skill they possess and the skill desired will form the "training gap".

Bearing in mind that the overall thrust of this project is to provide technical assistance this process has already been initiated. During the Human Resources Experts first visit questionnaires were devised to elicit this information. The questionnaires were designed so that the person to whom a position reports would first identify the most important duties and responsibilities of the position, would then describe or rate the competencies required to carry out each duty or responsibly and would then rank the incumbent against those particular competencies. The same process would be undertaken by the incumbent. The questionnaires were translated into Russian and, during the Human Resources Experts second visit, they were explained in detail to the principal officers in the railway who were charged with their completion.

The completed questionnaires will be collated and analysed so as to develop a picture of both the current and future training needs and the existing skills level within the organisation. The net result of the analysis will be a data base of skills shortages which can then be co-ordinated across the different departments and developed into a coherent development plan.

This, however, is only one of the potential uses of the information collected in this questionnaire. It can also act as a communications mechanism between and incumbent and superior so as to ensure that there is a clear and shared understanding of the principal duties and responsibilities of a post and of the current state of development of the person charged with these responsibilities. It can act as a blue print for future recruitment and selection so that the criteria are clearly and objectively defined and the selection process sets out to elicit information around those areas. It can also be used as a mechanism for succession planning. In this context the skills which will be required of the potential are identified they can then be exposed to experiences which allow they to develop the pertinent skills sets so that, when a position becomes vacant, there is a "qualified pool" from which to choose the successor. A copy of the questionnaire is included as Annexe 1.

The identification of the needs is, however, only one side of the equation. It is also essential that the resources required to deliver the necessary training are identified. In order to assist UTY, the Human Resources Expert made contact with a number of training providers in Tashkent so as to evaluate their capabilities. While a large number of bodies were contacted the organisations with whom the railway should seriously consider developing longer term relationships are:

- Railway University
- University of World Economy in Diplomacy
- Taiskent State Economic University
- CAP Group
- Market Skills Development Centre

#### Railway University

The Railway University is a very typical soviet training institution in that it provides a high level of technically orientated transport training which produces highly competent specialists in railway technology. In any railway of the future there will still be a need to provide this level and type of training. However, this training will not be enough to develop the commercial orientation which will be required for the future railway. The Management courses provided are very much in the soviet mold and do not contain the necessary ingredients which will need to be provided if the managers within the railway are to have the correct commercial focus. The university campus itself is a good facility and could be utilised by the railway to provide on-going training, both in the area of technical proficiency and in the development of new courses and curricula to meet the emerging needs. There is no suggestion that the railway university facility should be by-passed in any future initiatives. On the contrary the facilities provided by the institute will be necessary and can be developed to meet the longer term training needs across wide spectrum of areas. Some samples syllabi which have been translated are included as Annexe 2 for information

#### The University of World Economy and Diplomacy-Institute of Management

A number of meetings were held with Mr. Djuraev, the Director of Institute of Management attached to the University of World Economy and Diplomacy. This Institute was established in 1992 by a special decree of the president and is regarded by the cabinet of Ministers as having a pre-emenent place in the development of the commercial and enterprise culture being put in place in Uzbekistan. For example they were instrumental in training the first twenty five managers of the Uzdaewoo plant when this was established in Taiskent. The facilities within the Institute are of an extremely high standard and would compare favourably with those in most similar Institutes in the west.

Having established its position in relation to the private sector, the Institute is now interested in becoming involved in the development of the public sector particularly as this sector moves towards a more corporatised and/or privatised culture. The Institute can offer a range of learning experiences from short, focused training programmes through developmental programmes and on to the level of MBA. This MBA is being offered in conjunction with a British University through distance learning with the Institute acting as the local centre. Following the consultants contact with the Institute, a process has begun with the end view of establishing a long term relationship between the Railway and the Institute. The Institute would then be a provider of training to managers within the railway. While this type of long term relationship is important in the context of developing managers it should also be noted that the relationship should not exclude using other sources. It has been the experience of the consultant the different learning institutions can offer different perspectives and this can only be a good thing in developing a diverse but complimentary management culture within the railway.

## Tashkent State University of Economics

Tashkent University was founded in 1931 as Tashkent Financial Institute. It is now the largest higher educational institution in Central Asia, with 5,000 full-time students, 2,000 correspondence students, 500 students undertaking Masters programmes and a further 700 students going through regional centres in Samarkand, Bukhara, Kokand, Karshi, Urgench and Turtkul.

There are a number of faculties within the University which should be of particular interest to the new railway management. These faculties include a faculty of management, a faculty of marketing, a faculty of economics which includes a specific section on international accounting standards and a faculty of information systems. Additionally the University prepares candidates for Masters Degrees in economics and in business administration. They are also involved in a joint venture with the Vienna Institute and are a regional centre for the CIS countries. They are, additionally, a joint banking finance school on behalf of the World Bank in Uzbekistan. One of the benefits of these joint venture institutes is that, on a regular basis, lecturers from western educational institutions and from financial institutions come to share views and expertise with these students.

## CAP Group

The CAP Group was established by Jennifer Cock, who is herself a business law specialist and was previously a co-ordinator for the EC TACIS Programme on management training in Uzbekistan. There are a number of aspects of the CAP operation which commend themselves to the consultants. In particular the fact that the CAP Group can offer training leading to accreditation by recognised western bodies is a significant plus. This of itself often provides the motivation that managers need to continue with courses of study - much of which must be conducted through their spare time.

CAP Group are registered centres for the Institute of Management in Great Britain who would be in the forefront of promoting management based NVQ's and in implementing the British Governments MCI Initiative. Additionally the CAP Group are developing and using local Uzbek trainers. This has the advantage that the programmes can be conducted in Uzbek and therefore offer a much better utilisation of time than having to go through a medium which need to be translated. Additionally the CAP Group can offer programmes leading to qualification by the Chartered Institute of Accountants (CIMA) and the Institute of Personnel and Development (IPD).

#### Market Skills Development Centre

The Market Skills Development Centre was set up in January 1995 under an initiative of the TACIS Programme. The facilities offered by MSDC are to a very high standard and, while it was not possible to assess the actual learning experiences offered as no courses were been undertaken at the time of visits, the curricula would compare very favourably with similar institutions in the west. They particularly offer programmes which aim to raise the skills level of existing managers or broaden the focus for those with existing specialisation's. They also provide distance learning facilities for entrepreneurs which could have significant relevance in the context of future privatisation.

To summarise the training issues, there is a need to:

- identify the particular positions in the new organisational structure
- identify the critical duties and responsibilities of the particular position
- identify the skills sets which will be needed to realise those objectives
- identify those people who will be appointed initially to those positions
- identify the existing skills levels of these people
- analyse the difference between the existing and required skill sets
- develop a training programme to bridge the gap between the two

This however will only deal with the short term training needs. In order to provide a pool of talent from which future managers can be selected it is essential to identify, at an early stage of there career, those people who have the potential to rise to senior positions. The skills sets which they possess must be measured against the posts which they will potentially fill at a later stage. Any gaps between the requirement and what they possess can be bridged both by providing learning experiences and by ensuring that these people with potential are exposed to work experiences which will allow them to develop the necessary skills they will require at later stages in their career.

#### Information Systems Requirements

The restructuring which UTY will undergo will mean major change in all areas. The degree to which these changes will impact on the Personnel or Human Resources Department will be at least as great, and probably greater, than the impact felt in many others. It is essential, therefore, that the personnel department prepares itself thoroughly for the requirements of the new organisational structure and takes the opportunity to improve and update their systems and procedures. While the existing system has served well the needs of the railways the demands which will be placed upon it in the future are markedly different. The system of records which currently exist within UTY is largely manual and this makes the extraction of meaningful data for decision making both time consuming and labour intensive. As a result it is very difficult for the personnel department to respond in a timely manner so as to provide the information that managers need to make good quality decisions. In a modern railway structure the function of the human resources department must be to assist other departments in the achievement of business objectives. In order to do this the consultants recommend that UTY should actively consider moving to a computer based human resources management system. Some of the activities which would lend themselves to this type of approach would include:

#### Payroll Administration:

This could be done speedily and accurately and could ensure that consistent application of conditions of employment applied throughout the railway. It would also mean a considerable cost saving as the payroll could run almost automatically other than for exceptional circumstances.

#### Employee Records:

These records would be linked to payrolls for automatic set-up and would automatically update all relevant details.

### • Pension/Benefits Administration:

Again, consistency throughout the organisation would be ensured through the computer based system along with a significant increase of speed and accuracy.

### • Salary Administration:

The benefits which accrue to payroll administration also accrue here. Additionally however it is possible to safeguard access to salary levels through the use of security systems such as passwords etc.

#### • Budgeting:

The system could help to ensure up to date knowledge of staff numbers, grades and could provide wage costs by location if so desired.



#### • Training and Development Administration:

The System would allow for the automation of arrangements, for measuring the degree of investment in training, for recovering the costs of running the training function and for establishing and maintaining an up to date training records system.

#### Skills Database:

The system will allow the development of a skills database which can significantly improve the speed and quality with which vacancies are filled, can provide the raw data for training needs assessment and can provide speedy and accurate information as to the attributes of potential high fliers.

#### Successful Planning:

Because records are easily accessible and can be searched using a number of different criteria, the system enables the identification of potential senior managers and can track their developments over the course of time.

#### • Man Power Planning:

Provides up to date, readily accessible, information on the number of staff compared to requirements and can provide sophisticated "what if" scenarios for planning future manpower requirements.

#### • Recruitment:

Though tracking previous success and providing detailed job analysis, the system can substantially reduce the opportunity for error. It allows automation of the system and can measure the success rate of various media in attracting appropriate personnel. It can also help to build a competency database for future reference.

#### Position Control:

Safeguards can be built into the system to ensure that only those people who are authorised can change or increase the number of positions within the organisation. It can also flag up the vacancies which will become available so as to ensure a more seamless, well planned approach.

#### • Performance Appraisal:

The system substantially reduces the administration time and can ensure consistency throughout the organisation in the application of performance appraisal methodologies and criteria.

#### • Organisational Charting and Development:

The system would readily reflect the changes in the organisation and could alert the change agent to possible reinfatications of changes in relationships and reporting structures.



The above covers most of the major functions which would be undertaken by a human resources department. It is not however intended to be exhaustive. The particular requirements of any organisation can be accommodated within most modern computer based human resources management systems. These systems can be either PC or mainframe based. On balance, the consultants would favour a PC based system because of the wide variety of software available and because of the high level of support which is available for most of these programmes. What is important, however, is that the acquisition and implementation of such a system would, of itself, drive forward procedural changes which could help the human resources department to move towards the best practice scenario.

#### 13.5 Conclusions

The human resources function can, and must, play an important role in the impending organisational change in UTY. There is often a danger that the human resources department is charged with deciding on the magnitude of the downsizing requirement and of being charged with the implementation of that procedure. This should be guarded against. It is line managements function to determine the staffing requirements needed to realise their business objectives. Naturally this will be done with the co-operation and assistance of the human resources department, who can advise on techniques and who can point line managers in the direction of current best practice. However it must be recognised that the human resources manager will not necessarily have to live with the day to day consequences of the decision. This will be the function of the line manager.

The current emphasis within the human resources department on the provision of social obligations must change in the immediate future. The purpose of any human resources department must be to assist line managers in the achievement of business objectives. This is not possible in a structure where social obligations predominate.

A pivotal role for the human resources department will be to assist in the identification of training needs and in the provision of training for the new organisation. It is in this area that the most significant contribution can be made by the human resources department in the short term. In the medium to longer term the continuation of the human resources departments input into training and development is very important, but so also is the management of the human resources function so that timely and accurate information can be available to line managers, and to senior managers, to aid them in decision making.

13.6



#### Recommendations

To summarise the recommendations in the human resources area:

- When the decision of the form and type of organisation has been reached the human resources department should first assist the line managers to; define the job requirements for the new organisation and to arrive at a staffing level best suited to the achievement of the business objectives; to continue the analysis started by the consultants of the skills and competancies which will be required; to continue the assessment of the existing level of these identified skills within the current or potential staff; and to implement a transparent selection process which takes account of the various dimensions appropriate to the filling of the position.
- The human resources department must divest itself of the level of social obligations which it currently carries out; to assist with the establishing of the restructuring agency; to assist in the transfer of redundant railway staff to the new agency. If the restructuring agency is to remain within the railways to assist in the economic analysis of the jobs market place within Uzbekistan with a view to defining the skills needs; to draw up and implement a re-training programme for the redundant staff; to assist with the out-placement of these redundant staff.
- They would also assist with the smooth transfer of the management of the medical educational and housing facilities to the restructuring agency.
- The human resources department will be the focal point for the initial contact and development of
  relationships with the learning institutions identified by the consultant and will monitor the
  training and educational environment so as to involve any new appropriate training bodies. They
  will also need to establish a system of monitoring the provision of training and to validate the
  training which has been delivered.
- The human resources department should identify and implement a computer based human resources management system to assist them in their move towards best practice in the administration in the human resources function.

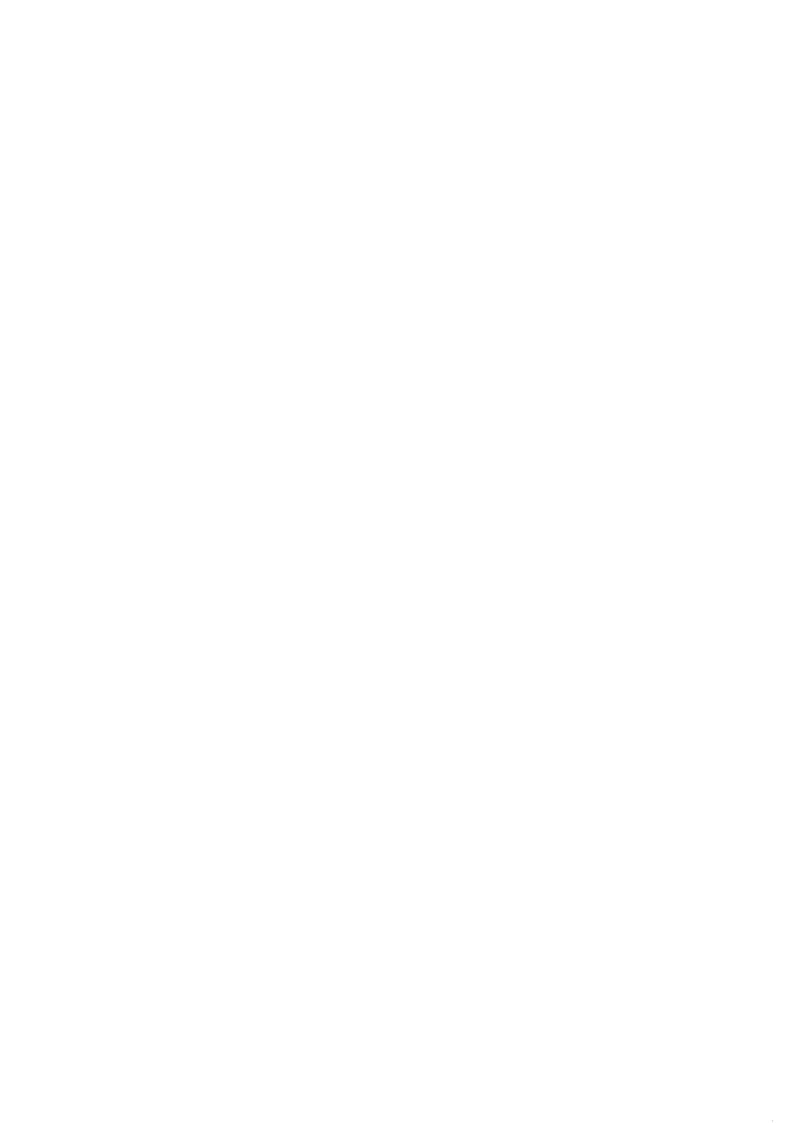


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# APPENDIX A



#### ORGANISATIONAL QUESTIONNAIRE Uzbekistan Railways / Temir Yullari

This questionnaire is designed to help identify the core competencies which will be required to cope successfully with the change to the market driven economy and to measure the extent to which they already exist within your organisation. As a byproduct, it should also help define areas of responsibility and to highlight any potential areas of overlap. The questionnaire is in three sections, the job, the duties and the person. If it is to be effective it is important that all questions should be fully answered. As an initial step these questionnaires should be completed for the top three layers in the organisation. This specifically means the Chief Executive, those managers who report to him and the people who report to them. In each case, the questionnaire should be completed by the superior officer and, independently, by the job holder.

The information obtained in this way can be used in a number of ways. Firstly, it is a useful mechanism to create shared understanding of the critical elements of specific positions between superior and incumbents. Secondly, the information gathered is the first stage in the process of carrying out a detailed training needs analysis. Thirdly, it makes the task of identifying those skills needed for succession planning considerably more straightforward and, finally, it allows the organisation to start to develop a skills database for its management staff.

Any information collected through this process would, of course, be treated with absolute confidentiality.

#### **SECTION 1 - THE JOB**

Job Title				
Reporting to			<del> </del>	
Supervising the following				
				<del></del>
Main areas of				
responsibility				
		·		
		·		<del></del>
		······································	***************************************	
Principal Duties				
				· · · · · · · · · · · · · · · · · · ·
		· · · · · · · · · · · · · · · · · · ·		
Timita of a distri				
Limits of authority				
Desirable				
Qualifications				
	•			· · · · · · · · · · · · · · · · · · ·
Desirable experience				
				* · · · · · · · · · · · · · · · · · · ·

#### **SECTION 2 - THE DUTIES**

Using a ranking method (e.g. paired comparisons) identify the most important duties of the particular position (up to six duties). Then rank these duties in order of their importance, e.g. the most important duty as number one, next most important as number two, etc. For these duties rate the importance of each of the following competencies, on a scale of 0 to 10, where 0 means the competency is not required and 10 means it is critically important to the carrying out of that duty.

<b>.</b>		
Duty :	1	
Duty.	^	

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty 2	
Duty 2	· · · · · · · · · · · · · · · · · · ·

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty:	
•	

Competency	Rating	Competency	Rating
Influencing skills	-	Communication skills	
Leadership		Interpersonal Skills	1
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	<del>-   </del>
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty 4	
--------	--

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	

Resilience	Adaptability	
Personal Motivation	Action Orientation	
Technical Skills	Commercial Awareness	

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty	6	
~		

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

#### **SECTION 3 - THE PERSON**

For the holder of this job, go through the same process as in section 2 for each of the six duties. This time, however, you should show, in the rating column, the extent to which the person possesses the particular competency.

D	
Duty 1	
•	

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	1,441
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	<del></del>
Personal Motivation		Action Orientation	<del></del>
Technical Skills		Commercial Awareness	

## Duty 2____

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	<del> </del>

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	Kating
Leadership		Interpersonal Skills	<del> </del>
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty .	

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	Rating
Leadership	· · · · · · · · · · · · · · · · · · ·	Interpersonal Skills	<del></del>
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	
Resilience		Adaptability	
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	

Duty 5
--------

Competency	Rating	Competency	Rating
Influencing skills		Communication skills	Rating
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	
Problem Analysis and Solving		Creativity	<del></del>
Resilience		Adaptability	<del></del>
Personal Motivation		Action Orientation	
Technical Skills		Commercial Awareness	<del></del>

Duty 6	
Duty 0	
·	

Competency	Rating	Competency	Dating
Influencing skills		Communication skills	Rating
Leadership		Interpersonal Skills	
Strategic thinking		Planning and Organising	<del></del>
Problem Analysis and Solving		Creativity	<del></del>
Resilience		Adaptability	
Personal Motivation		Action Orientation	<del> </del>
Technical Skills		Commercial Awareness	<del> </del>

# APPENDIX B



#### DEPARTMENT OF SKILL UPGRADING OF THE MANAGEMENT AND RAILWAY TRANSPORT EXPERTS

## MAIN TRENDS OF SKILL UPGRADING AND AUDIENCE FORMATION

### NEW KNOWLEDGE IS YOUR SUCCESS

Faculty for Skills Upgrading (FSU) of the management in railway transport specialists was created twenty years ago as structural subdivision of Tashkent Institute of Transport Engineers (TashIIT) named after A. Ikramov.

Tuition at FSU is conducted according to the updated programs compiled on the basis of the latest scientific and technological achievements in the transport sector with regard to positions of the audience. Besides scientific and technical problems each subject covers general matters such as market reform basics, shifting of the locomotive crews and repair workshops to the method of lease contract, the role of the leader in the organization of work and leisure and creation of healthy psychological environment for the workers; law enforcement and etc.

Field classes are conducted in the training laboratory of TashIIT, enterprises of Central Asian railway, in Tashkent, Samarkand and other cities of the republic.

FSU has computer class room, and training and methodical aids for main trends of skill upgrading, and a comprehensive library is collected.

Training methods and academic supervision are performed by Professor S. M. Jumbaev (Chair), Prof. R. Z. Nurmukhamedov (Chair of Operations Management Department), Prof. I. S. Ravich (Chair of Transport economics and Management Dept.), Prof. E. S. Sevlikiyanz (Chair Political Economy), Prof. R. A. Yakubova (Chair of Labor Security), Prof. N. I. Silaev (Chair of Accounting and Finance), Prof. S. A. Artemiev (Head of Central Asian Railway Finance Department), Reader N. M. Belenky (Chair Wire Communications of the Railway), Reader B. Sh. Akhmedov (Chair of Locomotive Maintenance Dept.), Reader Sh. A. Irgashev (Chair of Track Maintenance Depart.), Prof. G. G. Gafurova (Chair of Foreign Languages Depart.), Prof. A. D. Belenky, acting Prof. R. D. Kapanchiev.

## Main Trend of Skill Upgrading at the FSU of the TashIIT

#### No Railway transport subsystem, major, audience, group Period of training index and studies opening date I. Operations Management **OPERATIONS**

1. **UPGRADING** OF STATIONS TECHNOLOGY:

1 month

Automatization of dispatcher's work station and; creation and development of Autamatic Control Systems at freight stations and terminals; computer classes. Field and

practical classes. - Station heads and engineers, dispatchers, operators, specialist from Operations Dept. of RW Regions (D-1).

# 2. OPERATIONS/MAINTENANCE CONTROL AT THE RW SECTIONS AND ROUTS:

1 month

Advanced experience of running trains, wagon flow control at RW routs. Technical regulations applicable to train operations; new equipment and information systems at the work stations. - Heads and specialist of dispatching offices in all administrative levels - railway, region, station (D-2).

#### 3. ENHANCEMENT OF PASSENGER SERVICES:

1 month

Innovations in passenger service in direct, local and commuter services. Station time table and preparation of trains for the trip; computerized box-office ("Express" Software) and work station set up; upgrading service quality. - Heads and specialist from Passenger and Wagon Depts., railway regions, stations, wagon workshops, depots (D-1).

II. Technology & Mechanization of Freight Operations

1 month

4. ENHANCEMENT OF FREIGHT & COMMERCIAL OPERATIONS OF THE STATIONS IN MARKET ENVIRONMENT:

Marketing, contract tariffs for freight and other services. Automatic Control Systems for container yards and freight stations. Computerized Work Stations of handlers at container yards and siding. Enhancement of handling technique and container/wagon utilization. International experience. - Heads and specialists engaged in freight and commercial operations. (K-1)

#### 5. SIDINGS OPERATIONS:

1 month

Maintenance of rolling stock, handling equipment and track devices. enhancement of contract relations in the market environment; rational utilization of wagons. - Specialist from all Depts. of railway workshops (K-2).

6. ENHANCEMENT OF RAILWAY COMMERCIAL OPERATION:

3 weeks 06.04 09.11

Filing in claims and shipment tracking. Using computers for tracking. Computerized work stations. Shipment security. legal relationships between parties involved in shipping process. - Specialists involved in filing claims and tracking shipments from railway stations, departments and divisions of the Railway Headquarters, enterprises, associations of "PromjeldorTransport" (railway transport),

ministries and sectors of national economy (K-3).

# 7. ENHANCEMENT OF AGRICULTURAL PRODUCTS TRANSPORT:

1 month 13.01 09.03

Theory and practice of the preparation of agricultural and perishable goods for transportation. Peculiarities of commercial and claim processing work. Contract relations, marketing and management, transport services planning in the market environment. Handling regulations and methods of transporting goods in refrigerator cars, maintenance and repair of refrigerator cars. - Specialists from all enterprises and management levels, divisions of agro-productional complex involved in transportation of agricultural and perishable goods (K-4).

#### III. WAGONS AND WAGON DEPOTS

8. ENHANCEMENT OF FREIGHT WAGONS AND PASSENGER COACHES MAINTENANCE QUALITY IN THE CONTEXT OF TRANSITION TO THE MARKET ECONOMY:

1 month 10.02 12.10

Mechanized repair work; streamlining of wagon depots operations management, maintenance in the market environment. Marketing. - Heads, engineers, senior foremen from maintenance and wagon preparation workshops (V-1).

# 9. ENHANCEMENT OF REFRIGERATOR CARS AND TRAINS MAINTENANCE QUALITY:

1 month 09.03 07.09

Innovations in maintenance of refrigerator cars before loading and en route; transportation of agricultural and perishable goods; basics of commercial operations and claim processing. - Heads and mechanical engineers from refrigerator trains and cars, refrigerator depots foremen (V-2).

# IV. AUTOMATIC AND TELEMECHANICAL SYSTEMS ON RAILWAY TRANSPORT

10. ENHANCEMENT OF MAINTENANCE AND REPAIR OF AUTOMATIC AND TELEMECANICAL DEVICES: Basic principles of microprocessing equipment application; enhancement of operational and economic activity of track distances; preventive measures for train operations safety; increasing of automatic devices reliability. Means that prevent passing through on the stop signal along automatic blocking sections with reduced insulation resistance. - Heads and maintenance specialists working with central blocking systems. (Sh-1).

1 month 09.03 09.11

11. MODERN EQUIPMENT AND PROBLEMS RELATED TO MANAGEMENT OF SIGNALLING AND

1 month 13.01

# COMMUNICATIONS DEPARTMENT IN THE MARKET ENVIRONMENT.

Organization and planning of operations and management; introducing of new automatic and telemechanical devices, securing safety of train operations during the overhauling and maintenance period. Field classes at Tashkent, Samarkand and Bukhara Signaling and Communication Distances. - Heads and Chief engineers, engineers, heads of sections (Sh-2).

#### VII. TRACK AND TRACK MAINTENANCE

### 27. INCREASED RELIABILITY OF RAILWAY TRACK:

Basic theory of reliability and preventive measures for preserving the condition of track structure; scientific and technical progress in track maintenance; enhancement of economic mechanism of Track Distance operation in the market environment. Mechanized regular maintenance; continuous rail track, specific nature of its maintenance and repair in Central Asia. - Heads and specialist from Track Distances, Track Machinery Stations and other Track Maintenance Depts. (P-1).

1 month 10.02

### 28. ENHANCEMENT OF TRACK RELIABILITY:

Existing condition of track infrastructure, main trends of its maintenance and measures to insure the reliability of track. Interaction of track infrastructure and rolling stock and train operations safety; mechanized current maintenance with the use of heavy machinery. Basic principles of operations and financial activity. - Heads of sections, senior foremen, foremen of Track Distances and areas (P-2).

1 month 6.04

# 29. ENHANCEMENT OF CURRENT MAINTENANCE OF CULTURE:

Mechanization and automatization of work: specific nature of maintenance of culture and ground bed in Central Asia; basic principles of estimating the reliability and traffic capacity of the culture. - Foremen of bridge maintenance gangs, engineers and technologists, deputy heads of in charge of Track Distances culture (P-3).

1 month 1.06

VIII. CONSTRUCTION MATERIALS AND INDUSTRIAL AND CIVIL ENGINEERING:

30. ENHANCEMENT OF TECHNOLOGY AND METHODS OF CONSTRUCTION IN MARKET ENVIRONMENT:

industrialization, complex mechanization, automatization, and new materials used for construction. Advanced technologies used for erecting dwellings, public and industrial buildings and constructions. Enhancement of economic mechanism of construction process: planning, budget estimates, pricing, logistics, financing and crediting, wage and labor motivation system; system of self-finance and lease. Modern methods and forms of construction management. - Heads and specialists, engineers, gang masters of construction trusts (S-1).

1 month 09.11

### 31. EXISTING METHODS OF QUALITY CONTROL OF

#### **CONCRETE MANUFACTURED ARTICLES:**

types of concrete by strength; homogeneity of concrete; control over concrete homogeneity to insure that class requirements are met; advanced methods of upgrading the quality of concrete and ferroconcrete improvement of concrete mixtures and steam-cure treatment; use of chemical additives, including superplasticizers; personal computer use. Experience of advanced enterprises of Tashkent and Tashkent province. - Chief engineers, heads of laboratories at the factories and railway construction trusts, heads of quality control departments and factory technologists (S-2).

1 month 01.06

# XV. STAFF MANAGEMENT AND OPERATIONAL AND ECONOMIC TRAINING:

44. IMPROVEMENT OF STAFF MANAGEMENT IN MARKET ENVIRONMENT:

Existing problems in staff management, basic principles of office work, Soviet Labor and Economic Codes. Computerized work stations of the employees of personnel department. - Heads, senior inspectors of personnel departments of line railway enterprises (NOK-1).

3 weeks 10.02

45. IMPROVEMENT OF OPERATIONAL AND ECONOMIC TRAINING QUALITY:

training methods. Scientific and technical progress; self-financing; utilization of fixed assets; basic principles of labor, economic and criminal law. Technical aids in training. Basic principles of market economy - development of the forms of ownership, taxation, wage system and social insurance, financial relations and banking system, development of foreign economic relations. - Trainers, methodologists and from line enterprises (NOK-2).

3 weeks 09.11

46. UZBEK LANGUAGE STUDIES. -Faculty and ancillary academic staff from all departments of the Institute (ZU-1).

1 month 09.09

Note: Audience consists of members of management staff and specialist who is to be promoted.

# DEPARTMENT OF SKILL UPGRADING OF THE MANAGEMENT AND RAILWAY TRANSPORT EXPERTS

#### Chair "RAILWAY ELECTRIC COMMUNICATIONS"

#### MAIN TRENDS OF SKILL UPGRADING AND AUDIENCE FORMATION

NEW KNOWLEDGE IS YOUR SUCCESS

# SPECIALIZATION, SCOPE OF STUDIES, AUDIENCE, GROUP INDEX

MODERN DEVICES OF ELECTRIC COMMUNICATION AND THEIR TECHNICAL MAINTENANCE:

Quasi-electronic and electronic Automatic Telephone Stations, digital transmission systems, fiber-optic transmission lines, discrete message transmission terminals, facsimile and wire communication; "Transport" radio transmission system. Microprocessor equipment basics, personal computers. - Deputy Heads and specialists of the communication distances (enterprises), section heads (Sh.-3).

#### TECHNICAL MAINTENANCE OF DIRECTING SYSTEMS:

Maintenance methods of communication facilities along the railway line, malfunction diagnosis, certification and electric measurement of the communication lines performance, protection of circuits and lines from the external electromagnetic fields of electric railway lines, high voltage transmission lines and radio stations. Ways to reduce mutual influences of the circuits. - Line electricians and mechanical engineers, section heads of local and main communication networks. (Sh.-4).

#### TECHNICAL MAINTENANCE OF INFORMATION TRANSMISSION SYSTEMS:

Transmission systems with time diversity, specific features of design and maintenance of digital transmission systems and fiber-optic lines. Development of primary and secondary electric communication networks. Methods of network management and transmission systems maintenance. - Section heads, senior electric and mechanical engineers, tool engineers. (Sh.-5).

TECHNICAL MAINTENANCE OF OPERATIONAL AND TECHNOLOGICAL COMMUNICATION EQUIPMENT:

New systems of operational and technological communications, specific features of its organization with the introduction of central (automatic) traffic control centers, interaction of ASO-VII and telemechanic systems. - Specialists working with technological communications devices (Sh-6).

TECHNICAL MAINTENANCE OF DISCRETE MESSAGE TRANSMISSION EQUIPMENT:

Principles of network building and terminal transmission devices. Use of microprocessor equipment and personal computers. Specific functions of Automatic Rail Traffic Control System, switching and channeling equipment. Facsimile and cable communication. - specialists of Signaling and Communication departments, data processing centers of the Railway and Underground (Sh-7).

TECHNICAL MAINTENANCE OF GENERAL TECHNOLOGICAL TELEPHONE COMMUNICATION:

New switching systems of local and international telephone communication, their operating principles and toll station numbering system. Methods of diagnosis. Microprocessor devices and the latest models of telephones. - Section heads, specialists from signaling and communication departments (Sh.-8).

TECHNICAL MAINTENANCE OF TECHNOLOGICAL RADIO COMMUNICATION:

Electromagnetic compatibility of radio communication means, diagnosing and measuring of radio stations parameters. Technical means of "Transport" radio communication and specific features of its maintenance. - Computer engineers from signaling and communication departments, electric and mechanical engineers of radio telecommunication and relay lines (Sh-9).

ELECTRONIC DEVICES IN MODERN SYSTEMS OF ELECTRIC AND RADIO COMMUNICATIONS:

Element base of transport communication devices, basics of building and application of microprocessing equipment and personal computers, computer use for work stations. - specialists of Signaling and Communication departments of the Railway and Underground (Sh-10).

# DEPARTMENT OF SKILL UPGRADING OF THE MANAGEMENT AND RAILWAY TRANSPORT EXPERTS

# Chair "OPERATIONS MANAGEMENT" "FREIGHT OPERATIONS TECHNOLOGY"

#### MAIN TRENDS OF SKILL UPGRADING AND AUDIENCE FORMATION

NEW KNOWLEDGE IS YOUR SUCCESS

# SPECIALIZATION, SCOPE OF STUDIES, AUDIENCE, GROUP INDEX

#### ENHANCEMENT OF STATION OPERATION TECHNOLOGY:

Dispatcher and operator work stations automatization; experience and development of automatic control systems at the freight stations and terminals; computer courses. Field classes at the stations. - Heads and station engineers, dispatchers and operators, personnel of transport department and services (D-1).

#### RAILWAY SECTIONS AND ROUTS OPERATIONS CONTROL:

Experience of advanced dispatching and train operations control, organization of wagon traffic and local work at the railway routes. Technical regulation basics of operations; new equipment, data processing complexes at the work stations. Functions of traffic control centers in the traffic control network and automatic railway systems. - All level dispatchers - Railway, its regions, stations (D-2).

# ENHANCEMENT OF FREIGHT OPERATIONS FOR AGROPRODUCTIONAL ENTERPRISES:

Theoretical and practical methods of agricultural and perishable goods preparation for transportation; specific features of commercial activities; contract relationships and freight operations planning in the market economy; technical regulations, handling and transport of agricultural produce in the refrigerator cars. - Heads and specialists of all railway enterprises and management levels, as well as heads and specialists of agroproductional enterprises (K-4).

Chairs "OPERATIONS MANAGEMENT" and "FREIGHT OPERATIONS TECHNOLOGY AND MECHANIZATION" guarantees high tuition level based upon recent scientific and technical achievements in solving transport-related problems.

#### DEPARTMENT OF SKILL UPGRADING OF THE MANAGEMENT AND RAILWAY TRANSPORT EXPERTS

### Chair "MAINTENANCE AND REPAIR OF LOCOMOTIVES"

### MAIN TRENDS OF SKILL UPGRADING AND AUDIENCE FORMATION

NEW KNOWLEDGE IS YOUR SUCCESS

# SPECIALIZATION, BRIEF INTRODUCTION INTO STUDIES, POSITIONS OF THE AUDIENCE, GROUP INDEX

ENHANCEMENT, ORGANIZATION AND TECHNOLOGY OF REPAIR OF DIESEL LOCOMOTIVES, THEIR SYSTEMS AND UNITS:

Methods and remedies to upgrade the reliability of the locomotives, their main and auxiliary equipment; spectrum analysis of the engine oil. Specific design, maintenance and repair of diesel locomotives (TOZ-TR1, TOZ-TR2, TOZ-TR3) and their separate systems. Assessment of the extent of repair works automatization. Introduction of the comprehensive system of repair quality control. — Depots heads and experts, engineers and employees of the overhauling and testing centers (T-1).

# OPERATIONS OF LOCOMOTIVE DEPARTMENT AND OPERATIONS SAFETY IN THE CONTEMPORARY CONDITIONS:

Analysis of operational, economic and ancillary activity of the locomotive depots, the nature of their relationship with the Railway Regions. Economic methods of management, labor cost analysis. Use of computers in the depots operation, automatization of the operation processes. Methods to analyze and forecast of the safety train operations. Organizing the work of the locomotives and locomotive crews. - Heads and experts of the locomotive departments, senior technologists, economists, depot foremen, specialists from the locomotive maintenance departments (T-2).

### SAVING OF FUEL AND ENERGY RESOURCES:

Norms and methods of resource consumption analysis. Introduction of the advanced engine oil and other lubricants saving technologies. Organization of fuel supply and automatization of locomotive equipment processes. - Heads and specialists of the fuel

supply sections of the locomotive departments, tutor-drivers of diesel maintenance, heads of fuel storage, people in charge of locomotive equipment (T-3).

RESOURCE SAVING TECHNOLOGY FOR THE LOCOMOTIVE MAINTENANCE:

Analysis of the need for spare parts and materials. Components restoration. Tearwear of the friction components. Technical and economic comparison and selection of the restoration method. Use of polymeric and anaerobic insulators. - Deputy heads of the maintenance depots, senior foremen, locomotive acceptance crewmen, engineers and technologists. (T-4).

CHEMICAL AND TECHNICAL CONTROL AT THE LOCOMOTIVE DEPOTS AND CTVR FACTORIES:

Modern techniques of chemical and physical analysis of the materials in the oil, water and fuel supply systems. Control over the electrolytic processes. Use of polymeric materials. Sewage water analysis, preparation of cooling water, use of activated water in the technological processes. - Heads and specialists of the railway, depot and factory chemical laboratories. (T-5).

REPAIR, MAINTENANCE AND VERIFYING LOCOMOTIVES SPEEDOMETERS:

New design of speedometers, verifying methods and techniques. After having attended the course the students get the certificate valid for five years which gives them the right to verify speedometers. - Foremen, heads of speed measuring units of depots and locomotive repair factories, instrument engineers (T-6).

MAINTENANCE AND REPAIR OF ELECTRIC FITTINGS OF ELECTRIC AND DIESEL LOCOMOTIVES AND ELECTRIC TRAINS:

Modern design of electric fitting and units of the diesel and electric locomotives and electric trains. Measures to increase the reliability and service life of electric equipment. Repair and testing technology. - Foremen and heads of electric equipment repair teams, electric engineers. (T-7).

Besides scientific and technical problems each subject covers general matters such as market reform basics, shifting of the locomotive crews and repair workshops to the method of lease contract, the role of the leader in the organization of work and leisure and creation of healthy psychological environment for the workers.

Chair "MAINTENANCE AND REPAIR OF LOCOMOTIVES" guarantees the highest training standards based on the latest scientific and technical achievements in the area of operations.

Training methods and academic supervision is performed by Professor A. D. Belenkyi.

Classes conducted on the basis of the agreement drawn between the Institute and Railway Head Quarters or its branches, as well as with any enterprise of national economy interested in the proposed subject-matters.

The payment is made according to the estimate and course duration. Advising on methodical issues is free of charge.

Field courses and practical lessons are given at the enterprises of the Central Asian Railways and the city of Tashkent.

Entertaining program includes sightseeing in Tashkent, Samarkand, Bukhara and other historical sites in Central Asia. Students are provided with accommodation at the faculty's hostel.

Classes begin on the 10th of every month, except the months of July and August. The course duration is from two weeks to one month.

#### Faculty:

Reader S. S. Mazkel - the Dean of the Skill Upgrading Department of the Institute. Reader B. Sh. Akhmedov - Chair.

Offers welcome by 1 october 1991.

Our address: 700045, Tashkent

1, Adylkhojaev TashIIT, FPK

Telephone: 99-03-33; 99-03-95 Railway tel.: 57-333; 57-395



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#### 14. Environmental Review

#### 14.1 Executive Summary

The policy, legal and administrative framework of Uzbekistan in the field of environmental and health protection is characterised by the persistence of the Former Soviet Union structures, norms, and standards. Since the independence of Uzbekistan, as for other FSU countries, and partly because of the current economic crisis, few attention - if any - has been given to environmental issues. The Uzbek Railways are not an exception, even if they are supplied with the Railway Scientific and Operational Centre for Environmental Protection, which assists them for ensuring the respect of the environmental regulations within the company. However, the RSOCEP actions suffer from lack of technical resources.

The disaster of the Aral Sea highlights the current environmental situation in Uzbekistan: the bad management of water resources and agricultural lands form the major problems in the country. In the present context of low motorisation rate and limited transport network, the transport sector, and especially railways, do not constitute a real environmental problem. As far as railways are concerned, the only significant environmental issues presently identified deal with noise emissions in the most populated areas, and with the potential pollution of surface and groundwater in areas of water reservoirs or water intakes.

The present environmental review focuses on the components of the restructuring process likely to induce environmental effects: rehabilitation of tracks, electrification of some railway sections, changes in operation, maintenance and manufacturing practices. The present traffic level over the railway network is rather low (57 trains per day on the busiest section) and the forecast, taking due account of the restructuring process, does not exceed 78 trains per day in the most optimistic hypothesis.

The main environmental impacts identified are as follows:

- improvement of the energy efficiency of the railway transport, thanks to the increased rate of electrification.
- decrease of air pollution assuming that the improvement in energy efficiency will reduce the
  pollution rate, all the more since Uzbek power stations use mainly natural gas, which is a very
  clean fuel,
- reduction of noise levels alongside the rehabilitated sections (by 4 or 5 dB(A)), despite the expected moderate traffic growth,
- waste production during the works period (ballast, rails, and sleepers),
- impacts linked to the procurement of new materials and associated operations (development of quarries, rails and sleepers processing, transport and storage, removal and replacement of the track materials).

In Uzbekistan, the transport of dangerous goods mainly involves petroleum products. Nearly all the dangerous goods are transported in tank wagons, which are on the whole outdated and worn-out. In the consultant's understanding, this specific issue is ruled by FSU regulations, which are less stringent than the international RID convention. However, for the time being, no major incident involving transport of dangerous goods by rail has been to deplore. Owing to some of the project components (track rehabilitation and improvement of signalling and telecommunication equipment), the transport of dangerous goods should gain in safety.

Other safety issues linked with railways activity concern the usual presence on the tracks of many people just crossing the line (generally where there is no crossing) or using the tracks for short distance trips between villages. This hazardous situation will worsen with the railways rehabilitation, because of the increase in train speed, if no preventive measures are taken. As to safety issues in UTY's industrial units, a visit to the Tashkent locomotive maintenance depot allowed to notice some lacks or inadequacies in safety equipment.

Before being able to define precise mitigation measures to the project impacts as well as to the present environmental issues identified alongside the railway line, it is recommended to carry out a Preliminary Environmental Inspection of the critical railway sections. The PEI will allow key issues to be identified and attention to be focused on the impacts and mitigation likely to be associated with them. The cost of the PEI, if performed by local experts, should not exceed 1,000 ECU.

Among the mitigation measures proposed within the present environmental review, the measures related to the rehabilitated lines operation ensue the necessity to progressively suppress the environmental « black areas » alongside the road and railway networks. These measures are aimed to reduce the noise and vibration levels, and the pollution of water and soil. Several types of measures are presented with their associated costs. It is assumed that these measures will approximately amount to 2% of the total cost of the track rehabilitation.

Several environmental specifications to be included in the overall Technical Specifications are given, in order to improve environmental protection during the works phase (e.g. environmental supervision of the works, noise and vibration control procedures, dust fly limitation, waste recycling or disposal on an environmentally responsible way). These measures should not induce extra costs, insofar as they are mainly organisational measures or legal measures likely to be integrated within any railway project.

With respect to rolling stock replacement, some technical specifications can also play a role in the reduction of air pollution and noise, such as: the use of disk brakes with a body profile and high phosphorous iron blocks, the replacement of ozone-depleting chemicals found in fire extinguishing systems, clearing and degreasing components, low engine noise levels, automatic engine shut-off after a predetermined period, ... It is assumed that the new locomotives and wagons will be fitted with most of the required environmental improvements without additional cost.

For the improvement of the safety conditions for the transport of dangerous goods and a better movement of these goods abroad, it is advised to join the RID convention, taking into consideration that some exemptions or adjustments are possible if required. As to other safety issues, it is recommended to provide side pedestrian paths on each section to be rehabilitated, and to launch a thorough safety expertise for all UTY industrial units. A budget of 10,000 ECU should be funded for this expertise.

Last, the RSOCEP means should be reinforced, in particular by the supply of new equipment, for ensuring the follow up of the previous measures, as well as for carrying out their current duties (cost estimate = 42,000 ECU).

The sketch of a preliminary action plan is provided, featuring the project components, the nature of the measures, their cost, and an indicative deadline.

### 14.2 Scope and Framework of the Present Environmental Review

The present Environmental Review follows the Initial Environmental Examination (IEE), prepared in the framework of the PADECO-JTC study, May 1997. The purpose of the present review is to update and complement the IEE, taking account of the forecasted changes in the project definition.

According to the EBRD's Environmental Policy and Procedures, the present project of railways restructuring in Uzbekistan does not need a full Environmental Impact Assessment (EIA), given that the environmental impacts can be easily identified and appropriate mitigation measures adopted.

So, the plan of the Environmental Review is limited to the following points:

- identification of the relevant national environmental laws, regulations and permitting requirements;
- description of the current environmental situation;
- identification of the key environmental issues;
- proposition of mitigation measures;
- sketch of a preliminary Environmental Action Plan (EAP).

The Environmental Review was prepared in line with « Environmental Performance Standards and Good Practices related to Railway Modernisation, EBRD, May 1995 ».

The scope of the Environmental Review has been extended, as far as possible to hygiene and safety issues as well as to transport of dangerous goods, though it was not the initial purpose.

Given the low definition level of the restructuring project, which is currently in its first stages, the extent of the study area (more than 350 track kilometres) and the limited allocated time for the Environmental Review, it was not possible to refine the assessment of the project impacts sufficiently to allow a precise definition and costing of the proposed mitigation measures.

It is assumed that further environmental analysis - which will refine the present assumptions and assessments - will be launched at the design stages.

The present Environmental Review has been performed by Mr Yves ENNESSER of SYSTRA / BCEOM, assisted by Mr Gennady DUROV Head of the Railway Scientific and Operational Centre for Environmental Protection, in Tashkent between the 29th of September and the 10th of October, 1997.

#### 14.3 Policy, Legal and Administrative Framework

This section provides the list of the main environmental regulations and standards under which the restructuring project will be carried out. These include both state legislation and internal UTY regulations and procedures.

#### 14.3.1 State Legislation

#### 14.3.1.1 Main Environmental Laws

In Uzbekistan, Issues related to the environment and natural resources management are regulated by the several laws, the most important in the framework of the present study being:

a) The Law on Nature Protection - 1992

It provides legal, economic and administrative grounds for preservation of the environment and rational utilisation of natural resources. Its purpose is « to ensure balanced and harmonious development of relationship between human being and the environment, to preserve ecological systems, natural landscapes and separate objects, to guarantee citizens rights for healthy environment ».

b) The Law on Governmental Sanitary Inspection - 1992

It specifies that every person has the right to receive accurate information about environmental issues.

c) The Law on Air Protection - 1981, revised in 1994

The basic objectives of this law are as follows:

- to preserve natural composition of the atmospheric air; prevention and reduction of detrimental chemical, physical, biological and other impact on the atmospheric air
- to legislatively regulate the activity of government agencies, enterprises, institutions, organisations, public associations and citizens in relation to preservation of the atmospheric air.
- d) The Law on Specially Protected Areas 1993

It defines general legal, ecological, economic and administrative grounds for preservation of unique natural environments which are regarded as national treasure, and are valuable from the standpoint of ecology, economy, science, culture, sanitary/recreation and aesthetics.

e) Can be added to the previous regulations the Land, Water and Forestry Law, Law on Underground Nature and Law on Vegetation and Fauna Protection.

# 14.3.1.2 Environmental Considerations in Project Design and Operation

The Law on Nature Protection says: "While locating, designing, constructing and technically renovating, operating or liquidating enterprises, facilities and other objects, environmental safety regulations have to be observed and actions taken to protect natural environment. During the stage of designing a project an Environmental Impact Assessment has to be carried out in compliance to the currently effective legislation and regulations and to be approved by the agencies of the State Committee for Nature Protection (SCNP). Reconstruction, retooling, or expansion of an active enterprise also requires an EIA if the original construction was carried out without EIA. Basically, the EIA procedure and content meet the international regulations in this field (e.g. Directive 85/337/EEC of 27 June 1985) and is supposed to include public participation.

In addition to EIAs (which must be prepared prior to construction), a special document known as an « environmental passport » is needed for the operation of enterprises. Environmental passports are basically permitting documents, and include detailed information, production methodologies, inputs used, waste produced, and the technologies used to control them. Passports must be updated every five years. These documents are prepared by the company environmental department, and are to be approved by the State Committee for Nature Protection, Ministry of Health of the Republic and the State Monitoring Committee for Industry and Mining in accordance with their competency. Environmental passports are also prepared, when the company lacks in environmental competency, by the department of State Ecological Expertise. The amounts of emissions and waste calculated through the environmental passport serve as a basis for the annual charge each polluting enterprise is supposed to pay.

Changing the air quality in a certain area or its pollution above set norms is not allowed. These norms are set on the basis of the enterprise emission rates, as well as existing quotas of pollutants emitted into the air by enterprises located in the territory of the Republic of Uzbekistan. Draft norms for Maximum Allowed Emission are designed by organisations which have special license and are to be agreed with the agencies of the State Committee for Nature Protection in a due order.

Surface and underground waters on the territory of Uzbekistan can be used on the condition of preserving the natural circulation of the necessary amount of water, its purity, aquatic vegetation and fauna, preventing any kind of water pollution, preservation of the natural ecological balance and preventing any kind of detriment to the water reservoirs as an element of a landscape. There are norms regulating maximum allowed emission into the water basin, which are defined by calculations. Draft norms for the maximum allowed emission are designed by organisations which have special license and are to be agreed with the agencies of the State Committee for Nature Protection in a due order.

Maximum allowed noise emission is regulated by the agencies of Sanitary and Epidemic Inspection ("SanEpidNadzor").

Exceeding any one of the maximum permissible concentrations or emissions result in financial penalties (fines).

The main norms and standards dealing with noise, air and water pollution are presented in Annexe 1.

## 14.3.2 Internal UTY Regulations

UTY does not have specifically designed internal regulations or procedures concerning environment. Activity in this regard is, on the whole, limited to the fulfilment of general requirements and provisions in accordance with the current legislation.

Nevertheless, the Railway Scientific and Operational Centre for Environmental Protection (RSOCEP) is responsible for issuing environmental guidelines and procedures for ensuring the respect of the environmental regulations within the company. Once gathered, these guidelines and procedures are included in the environmental passports.

## 14.3.3 Structures, Organisation and Responsibilities

Responsibility for environmental issues within the UTY is distributed according to the hierarchy (see following chart):

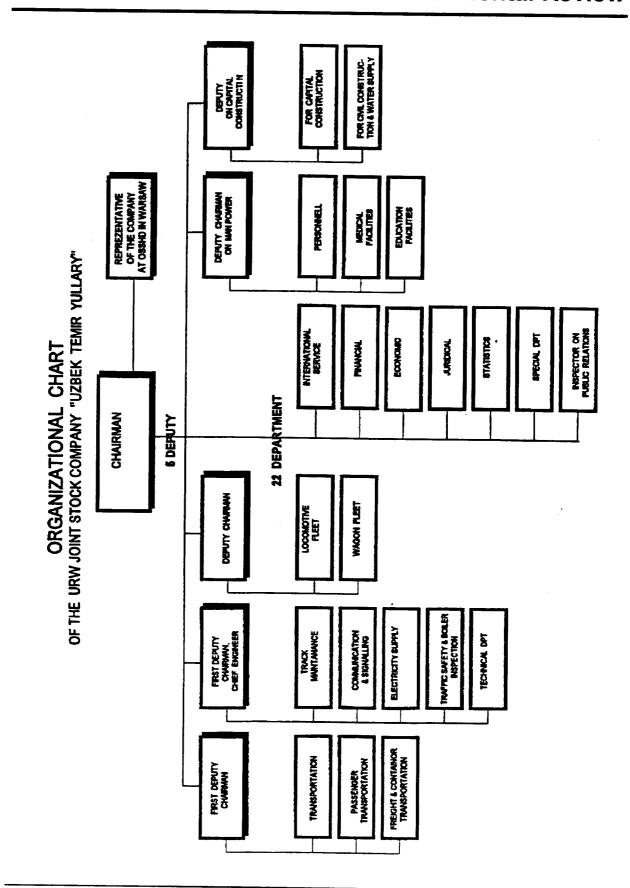
- the First Deputy Chairman of the Railways is personally responsible for this issue within the railways organisation;
- the technical Department of the Uzbek Railways is in charge of co-ordinating all related matters;
- further downward, in the railway regions and railway enterprises the responsibility for all
  environmental activity lies with the chief engineers of those enterprises or railway regions. It has
  to be noted that Tashkent Locomotive Repair Plant has special environmental laboratory which is
  to monitor detrimental emissions and wastes;
- lower in the subordination hierarchy, the chief engineers of the railway enterprises are responsible for all work aimed to protect the environment. Technical issues are the responsibility of an engineer or person from the operations security department of the enterprise. They are the people directly responsible for the enforcement of environmental protective measures stipulated in the Draft Norms for the Maximum Allowed Atmospheric Emissions and the Draft Norms for the Maximum Allowed Emissions into the Water Basin.

Besides this vertical split of responsibilities, at the horizontal level, the Railway Scientific and Operational Centre for Environmental Protection is supposed to assist the UTY operational departments for ensuring the respect of the environmental regulations within the company. The Centre is also in charge of calculating the volumes of pollution on which the company activities are charged, under the tight control of the local agencies of the State Environmental Committee.

The RSOCEP counts 46 persons, of which only 18 persons are qualified environmental specialists. The remaining personnel is entrusted with administrative tasks or varied commercial activities.

A heavy administrative staff and the need to find a financial balance (the Centre is financially independent from the railways and acts as a private structure), forced the RSOCEP to find other openings, far from UTY concerns. However, environmental assistance to UTY still counts for more than 70% of their activity.

Poor technical resources of the Centre does not allow to carry out necessary planned activity to monitor emissions and wastes at the enterprises. This factor impedes the resolution of environmental disputes with the agencies of the State Committee for Nature Protection at the railway enterprises. Besides that, depreciation of the Centre's assets prevents it from participating in the resolution of any issue which arises as the result of railway accidents.



# 14.4 Baseline Environmental Data

# 14.4.1 Current Environmental Situation in Uzbekistan

The current environmental situation in Uzbekistan is extensively dealt with in the PADECO-JTC report. It is not our purpose to start again a new thorough description of the environmental context. Hence, this section will briefly recall the main environmental features of Uzbekistan and then will focus on the environment specific to the main railway sections to be rehabilitated. A more complete description of the environment is given in annexe 2.

#### Present Environmental Situation in Uzbekistan 14.4.1.1

Being located between Amudaria and Syrdaria rivers the Uzbekistan territory covers maritime part of Aral Sea, Ustyurt Plateau, lower and middle reaches of Amudaria, Kyzylkum desert and mountain ranges of Tyang-Shan and Pamir-Alai. Total area of the republic is 44,457.6 thousand hectares, including 27,180.0 thousand hectares of agricultural lands of which 4,092.8 thousand hectares is arable land, 379.6 thousand hectares is orchards, 22,641.8 thousand hectares is pastures and area sown by fodder crops. The acreage of personal land plots not used for agricultural production is 1,330.3 thousand hectares.

Encroachment of deserts represents the major environmental problem for the republic, mainly due to the bad management of agricultural lands. This situation is made even worse due to poor watering and quality of ground waters, soil erosion, salinization, fall in productivity of ecosystems and other negative influences. The progressive disappearing of the Aral Sea is the most conspicuous consequence of water diversion for agriculture purpose.

The second issue in importance is deterioration of hydro-ecological condition of the region or the quality of surface waters. One of the main reasons for such situation is the annual disposal of 35-38 km3 of highly mineralised and polluted waters flowing from drainage and collector systems into the rivers, other reservoirs and natural lowered areas. Industrial wastes is also one of the critical factors that influences the quality of surface waters of the country.

Health of the people in Uzbekistan is directly dependent on the potable water quality. Deteriorated quality of potable water caused bowel and cancer diseases. Average life expectancy in Uzbekistan is 69.3 years, and the rate of infant mortality is 37.4 for 1,000 born infants.

With regard to air pollution issue, although being a secondary problem in Uzbekistan, it has started to be acute in big cities such as Tashkent, Andizhan, Bukhara, Samarkand or Gulistan, mainly because of automobile transport. Almalyk, Angren, Fergana and Chirchik experience serious air pollution problems because of their industrial activities.

### 14.4.1.2 Environmental Description of the Silk Route Railway corridor

The main railway sections to be rehabilitated in first priority belong to the Silk Road Route corridor, from Chengeldy (Kazakhstan) northward to Hodjadavlet (Turkmenistan) southward. According to environmental criteria, this route can be shared in three segments:

- Chengeldy-Tashkent-Mehnat,
- Mehnat-Samarkand,
- Samarkand-Hodjadavlet.



## 14.4.1.2.1 Chengeldy-Tashkent-Mehnat

In this corridor, the railway lies in the « Tashkent Oasis », which covers the vast expanse of flat plains titled upward towards the western Tiang-Shan ranges.

The terrestrial biome type of this sub-humid area is characterised by shrublands, with an annual rainfall of about 400 mm. The north-eastern part of this segment is wetter than in the Southwest. Natural vegetation is featured by couch grass and bulbous barley in the north-eastern part of the area, with ephemera (herbaceous and short-lived) species (e.g. *Flomis, Psoralea, Cusinia*) common in the lower part.

The precipitation being relatively abundant in this area, farming is the most common land use, especially cotton and wheat fields. The most industrial zone in the country is also located in this area. Residential areas are often found alongside the railway line, especially nearby the major stations (at approximately 50 m from the edge of the line).

There are no important aesthetic, archaeological, or historical resources in the railway vicinity.

## 14.4.1.2.2 Mehnat-Samarkand

The terrain is still flat, with some hilly sections in the Malguzar and Nurata Mountains area. The highest point of the Silk Road Route is reached at the Bogarnaya station, with an elevation of 876 m above sea level.

The crossed area lies in the Golodnaya steppe and Sanzar-Nurata hollow lands, surrounded by the Malguzar and Nurata Mountains. It can be considered as semiarid in mountains, with annual rainfall ranging between 250 and 400 mm, and arid in the lowlands, with annual rainfall between 180 and 280 mm. The vegetation features only ephemeral species: Flomis, Psorakea, Cusinia, Ferule, katran, ...

Winter cereals, mostly wheat, are cultivated in the mountainous zones, while cotton, wheat, barley, and some rice are cultivated in the western part. However, owing to aridity, the main land use is livestock grazing.

There are numerous cultural and historical sites in the Samarkand area, but relatively far from the railway line.

## 14.4.1.2.3 Samarkand-Hodjadavlet

The railway line crosses very flat lands, gradually falling in altitude westward to 250 m above sea level near the Turkmenistan border. It goes mainly through the Karshi steppe, the vast barren Kyzylkum desert (in the middle of the segment), and the salt marshes and streams of the Ustyurt plateau in the far west.

These are arid lands, with annual rainfall ranging from 180 to 250 mm, exhibiting only vegetation patches, with the same types of shrubs and grasses as found in the previous segment.

Here also the main land use is extensive livestock grazing, but owing to irrigation, wheat - and above all - cotton fields are rather common.

No important aesthetic, archaeological, or historical resources is reported in the railway vicinity.

### 14.4.2 Environmental Issues related to the Rail Transport Sector

Are differentiated impacts of the physical presence of infrastructures (spatial impacts), operational impacts of the present railway lines, and impacts related to the railway facilities (depots, workshops, manufactures).

### 14.4.2.1 Impacts Related to the Infrastructures

#### 14.4.2.1.1 General Points

Are addressed here the impacts of the present railway network (namely tracks and stations) in terms of land take, land use and spatial organisation, in rural or urban environment.

Of course, most of these impacts belong now to the past (e.g. land take) and the railway network is nowadays part of the overall landscape of the country. However, some effects - such as severance effects - of the infrastructure still play a role in the organisation of the population on both sides of the line.

Although the operational impacts of the railway lines are mainly dealt with in section 14.4.2.2, the potential impacts of the railway traffic on the landscapes or the natural environment are also addressed in this part.

#### 14.4.2.1.2 Land Consumption

The land requirements for classic single-tracked and double-tracked railways usually average respectively 8 m and 13 m, including shoulders.

In Uzbekistan, the railway density is very low: only 3655.3 km for an area of 447,400 km², i.e. 0.008 km of line/km², to be compared with 0.058 km of line/km² in France. In addition, most of the railway lines are single-tracked: 2972,8 km, i.e. 81% of the total network.

So, the total land take induced by the railway network is quite low (about 60 km²).

#### 14.4.2.1.3 Impacts in Rural Environment

In relation with the presence of the railway infrastructure, the following impacts may occur (or have occurred):

- a) destruction of farm lands;
- b) interruption of subsoil and overland drainage patterns (in areas of cuts and fills);
- c) landslides, slumps, slips and other mass movements in railway cuts;
- d) erosion of lands below rail beds receiving concentrated outflow carried by covered or open drains,

- e) disruption of wildlife through interception of migratory routes, disturbance of wildlife habitats;
- f) landscape disfigurement by embankments and cuts.

### Impacts on the Physical Environment

At a local scale, the railway fills or cuts are likely to have created new microclimatic changes by impeding or facilitating the circulation of the main winds. But this phenomenon may have occurred at a very small scale (less than 100 m from the line) and the environment has reached now a new equilibrium. Moreover, the network is located, on the whole, on very flat areas, and consequently the cuts and fills are of low height.

By the same time, the railway cuts and fills may have disturbed the drainage pattern of surface waters and shallow groundwater. However, it is reported that the bridges and culverts distributed along the lines evacuate the current flows and flood flows without experiencing significant damages and without creating noticeable disruptions downstream or upstream. It must be noted that most of the Uzbek rivers are provided with hydraulic or hydroelectric equipment and their flows are actually highly regulated.

No mass movements (landslides, slips, ...) occurred since the creation of the railway network. However, in Uzbekistan, the risks of earthquakes are high and the crossed areas could be subject of mass movement problems, especially in the mountain area. It is reported that during the 1966 seism, while one third of Tashkent was destroyed, no major damage affected the railway network.

### Impacts on the Natural Environment

The rather linear railway trajectories inevitably cross and divide natural sites, and can even destroy small biotopes and valuable sites.

#### a) Fauna

A linear infrastructure has often significant impact on fauna through its barrier (severance) effect, especially on large mammals. The barrier divides territories, separates different zones of the living area, affects feeding and breeding patterns, isolates populations, causes stress and consanguinity. It requires the restructuring of the biotope towards a new equilibrium. The animals most sensitive to barrier effects are those which migrate a lot, such as wild boars, and those which need a vast territory, such as deers, bears or wolves. The severance effect is all the more important than the infrastructure runs in deep cuts or on high fills. With respect to the Uzbek context, we can note that the railway lines run most often at the ground level or on small embankments and therefore do not form a large obstacle to fauna movements. In addition, most of the large mammals are confined to the North-eastern mountainous part of the country, and thus are not affected by the Silk Road railway sections.

Significant mortality of fauna is caused by overhead structures and by the effects associated with traffic. The whole range of fauna (birds, insects, ..., small and large mammals) fall victim to air movements, collisions, and crushings. The surprise effect, which is function of the speed of traffic, influences mortality. The primary influence of traffic to fauna seems to be additional stress.

#### b) flora

Firstly, a railway infrastructure induces the local destruction of the vegetative cover in the infrastructure right-of-way. Secondly, it leads to the fragmentation of biotopes. As was stated above for fauna, the fragmentation of biotopes does not generate the creation of smaller spaces of the same quality and value, but destroys the unit.

Impacts due to traffic are mainly to be assigned to the maintenance process and pollution aspects developed in a next section. They result in the destruction of vegetation, the retention of a corridor of low level vegetation, and the reduction of its biological potential.

To conclude about the severance effect of the Uzbek railway network on fauna and flora, it is clear than the infrastructure is, on the whole, detrimental for the populations but this impact is minimised by the low density of the network, the low barrier effect of the lines and the absence of rare or endangered species strictly dependant on the biotopes crossed by the railway lines.

### Impacts on Land Use

The main land uses of the rural landscapes crossed by the railway lines are agriculture and extensive breeding.

The main impacts of a linear transportation infrastructure on agriculture are the following:

- barrier effect, dividing functional units and connections,
- substitution effect, i.e. loss of agricultural area due to the taking up of area by the infrastructure itself or by the impossibility for further exploitation.

In Uzbekistan, the substitution effect is not perceptible anymore. The farms structure still reflects the soviet parcelization system. Any way, arable land is not lacking: in fact, the main limiting factor for agriculture is water supply.

As to the severance effect, given that 70% of the territory is arid or semi-arid with very low population densities, it is not considered here as a problem. Moreover, in the most populated provinces (Tashkent, Ferghana), high number of crossings are recorded along the railway routes, that greatly tempers the problem and allows the farmers to move relatively freely across the railway.

#### Impacts on Landscape

Usually railways create large scale visual impacts because of their strong linear character, very artificial and without aesthetic qualities. The presence of a geometric order prevails and contrasts with the random curves of the natural landscapes.

However, the visual impact of the infrastructure depends mainly on its « legibility », that depends itself on the natural or artificial screens which could hide the railway to the sight of residents or road users. Hence, in the flat and arid areas of Uzbekistan, the railway lines are visible from a distance. Even in the mountainous areas, the scarcity of the vegetation cover (especially trees) allows distant views of the lines, provided that it is not hidden by the terrain profile.

The longitudinal profile of the infrastructure is also of primarily importance: in cut section, the visual impact may be negligible, whereas when the railway runs on embankment, the impact is maximum.

Let us note that a diesel operated railway line is less detrimental on a landscape point-of-view than an electric railway line, because it does not need overhead systems (electric wires and associated metallic supports) which extends the visual impact of the infrastructure to a 6 m height above the tracks.

As to the visual impact of the traffic, given the low daily traffic figures, it does not seem to represent a significant trouble.

## 14.4.2.1.4 Impacts on Spatial Organisation and Urban Environment

Some of the issues addressed in section 14.4.2.1.3 apply also in an urban environment, namely land consumption, severance effect, visual impact. However, these impacts are assumed to be less acute or at least less detrimental - in an urban environment than in a rural context, because of the already high artificialisation of the concerned areas and the high density of railway crossings. Therefore we will not deal with it again in this part.

The purpose is here to present the function of large infrastructures, in the spatial organisation patterns and their influence on urban development and urban planning.

Regarding spatial organisation and the location of economic activities, large transport networks such as railways lead to contrasted situations:

- a) these networks enable to overcome the «tyranny of space». They can be used by regions/cities which are lagging behind, to overcome their peripheral position (remoteness from markets) through the use of new technologies/infrastructures, which is making them a part of the network.
- b) they lead to the concentration of economic activities in some core areas, as the networks are placed more easily in existing cores, and as they generate economic activity more easily in such cores. Regions which lack these networks can be isolated from the development processes occurring in modern economies of regions which are a part of the networks.

Thus, depending on the point of view, railway networks can be considered as positive or negative elements.

If we refine the analysis, we can say that the railway infrastructure has not in itself a negative effect and its use brings, on the whole, positive socio-economic spin-off. Nevertheless, these socio-economic benefits may not be shared by everybody. In fact, the traffic type using the infrastructure will determine how the positive spin-off will be distributed:

a) express trains do not stop in rural towns and so contribute only to the development of large regional cities. On the other hand, this kind of traffic does not interfere, and thus does not affect, the socio-economic fabric of the crossed rural areas,

b) local (stopping) trains serve as bonds between the rural towns and between the rural towns and the main cities. As such, they can have two opposite effects: they can either strengthen the economy of the small dwelling areas provided that towns or villages show already a certain economic dynamism, or on the contrary they can contribute to the decline of towns already fragilised by the current agricultural decline. The least situation often leads to the well known phenomenon of « rural desertification ».

With respect to the population structure alongside the railway network, the following tendencies can be draw up:

- a) the main cities, Tashkent, Samarkand, Namagan, Andijan, Bukhara, Fergana welcome significant industrial activities and can be regarded as development poles for which the railway is an important economic tool;
- b) the small towns, located at the periphery of these economic cores take profits from their vicinity and absorb part of the economic development;
- c) the rural towns and villages located between two economic cores are «aspirated» by the development poles, all the more easily if their economy is already damaged and if convenient transport means are offered. As a result, these villages may be progressively abandoned to the profit of the economic poles and the imbalance between the big cities and the countryside will increase;
- d) the rural towns and villages located far from any railway line are not influenced.

To conclude, it seems widely admitted nowadays that large transport infrastructures do not generate by themselves economic development: they only accompany it and facilitate it. They accentuate the socio-economic changes but they do not create them.

As to the influence of the railway on urban planning, it must be stressed that, contrarily to road infrastructures, railways have a very punctual impact: their influence is usually limited to the station district. In the rural areas the station is often the core of the village, from which the whole urban structure ensues. The low rate of motorisation incites people to leave as close as possible to the station. In larger cities, the structuring incidence of the stations on the urban fabric is less obvious; the station is no more the only structuring element and the city development depends less on it.

### 14.4.2.2 Pollution Generated by the Operation of the Present Railway Network

#### 14.4.2.2.1 General Points

The Uzbek railway network currently presents a relatively low traffic volume, of less than 60 trains/day (two ways) on the most busy section (29 freight trains and 28 passenger trains per day on the Dzhizak-Marakand section). In such context, the disturbances induced by the line operation must be considered as low (some busiest sections in EU have more than 400 trains/day two ways).

However, the severity of the impacts depends not only on the traffic flows but also on the sensitivity of the surrounding environment. Thus, the impact of possible water pollution mainly depends on the proximity of water courses of high ecological value or ground waters of high interest for potable water supply. The problem of soil pollution is above all acute in agricultural areas, and the noise disturbances are directly linked to the density and closeness of dwellings alongside the railway line. As to air pollution, it can be a sensitive problem at the local scale as well as at the international level according to the type of pollutant considered.

The purpose of this part is to define the nature and extent of the impacts generated by the operation of the present railway network, with respect to the environmental sensitivity. It will focus mainly on the rail corridors but also on site-specific features such as stations, workshops or freight depots.

### 14.4.2.2.2 Energy Consumption and Air Pollution

## Energy Consumption

Rail traffic is the most energy efficient mode of transport. This assertion, taken as a whole, is nowadays largely admitted. Incidentally, only a small share of the total energy consumption by the transport sector is attributable to rail traffic (2.6% on average for the European Union, while the rail sector carries about 15% of the passengers).

Energy use for traction comes from electricity or diesel oil. The present share of electrification of the Uzbek railway network is about 16%, meaning that most of the lines are still operated with diesel locomotives.

Yet, electric traction is usually more energetically efficient than diesel traction. For instance, in Germany, between 1953 and 1990, due to the railway network electrification, the overall energy consumption for traction decreased by 75% whereas in the meantime traffic flows increased by 35%.

Therefore, in Uzbekistan, there is a high potential for energy consumption reduction in the railway transport sector, through the increased use of electrical traction, provided that electricity would be generated by efficient plants supplied with fuels of good quality (see next section).

## Air pollution

Air pollution is one of the immediate environmental problems associated with energy production and use. Transport activities present a particularly difficult set of energy related environmental problems, given the steep increases in the sector's projected demand growth and its overwhelming reliance on oil (except for electric traction). The increasing share of emissions attributable to transport, their release at ground level in highly populated areas and the sector's dependence on products based on crude oil make it a priority area both for reasons of environmental quality and of energy security.

Emissions from transport sources include the following air pollutants:

- carbon dioxide (CO₂) emitted by the combustion of fossil fuel
- carbon monoxide (CO), hydrocarbons (HC) and volatile organic compounds (VOC), resulting from incomplete combustion
- nitrogen oxides (NOx) generated at high combustion temperatures



- lead (Pb), ethylene dibromide and dichloride added to gasoline to attain the desired octane rating and greater volatility of combustion by products
- sulphur dioxide (SO₂) due to the higher sulphur contents of diesel
- fine particles present in diesel
- formaldehyde and other aldehydes.

The pollutants emitted by the transport sector may cause direct and indirect effects on human health: irritation of respiratory, eye, or other systems, acute toxic systemic effects; mutagenic or carcinogenic actions; adverse effects on defence mechanisms against infections; and on the daily quality of life (odour, decreased visibility). "Direct" is to be understood as short and long term effects which are caused by the responsible pollutant before it undergoes chemical transformation if any in the atmosphere. "Indirect" is to be understood as short and long term effects which are generally caused by a mix of pollutants after they have undergone atmospheric transformation.

Effects on the environment are primarily long-term effects, which are generally caused by a mix of pollutants after they have undergone atmospheric transformation. These effects are of concern, not only in areas close to emission sources, but also at distant sites with no pollution sources.

Carbon dioxide (CO₂) is not by definition an air pollutant, since it is a natural component of the atmosphere. But, for a number of years, the concentration of CO₂ in the atmosphere has been increasing regularly because of the increasing use of fossil fuel, for which transport is largely responsible. This accumulation of CO₂ could cause a warming of the earth's atmosphere, by the well known « greenhouse effect ». CO, through the role it plays in some atmosphere reactions, can also contribute indirectly to this effect.

Sulphur (from SO₂) and NOx can undergo chemical transformation in the atmosphere, forming acids and acid salts (sulphates and nitrates) and returning to the earth as acid deposition. This phenomenon is usually called « acid rains », when associated with atmospheric precipitation. NOx emissions are converted to nitric acid and contribute approximately one third of the acidity in rainfall. It is now generally accepted that acid deposition impairs sensitive aquatic ecosystems, contributes to forest degradation, and corrodes materials.

NO₂ is further responsible for a portion of the brownish coloration observed in polluted air and, in combination with particulate nitrates, contributes to pollutant haze, reducing visibility. Diesel particulates are in the size range of the wavelength of visible light, and thus significantly reduce visibility.

According to data coming from the State Committee for Nature Protection, transport counts for about 60% of the overall pollution in Uzbekistan. This high share - given the low level of motorisation in this country - can be explained by an even lower level of industrialisation. The rail transport counts only for a small part ( $\approx 5\%$ ) of the pollution generated by the transport sector.

Two different sources of pollutant emissions from rail traffic can be identified: emissions from diesel locomotives and indirect emissions due to the generation of electricity for railway traction.

a) Diesel locomotives emissions are characterised by high rates of SO₂ and particles, compared to petrol-driven vehicles. In Uzbekistan, the low technical level and high fuel consumption of diesel locomotives induce high emission levels. Moreover, the diesel fuel is reportedly to include high sulphur content (as high as 2%) because of current lack of desulphurization unit

in Uzbekistan. Nevertheless, on the whole, this pollution is not much perceptible, owing to the low traffic observed. The main detrimental effect seems to occur at the stations, owing to the large volumes of pollutants emitted by diesel locomotives (especially emissions of particles) during acceleration phases of the engines when leaving the station or manoeuvring. These emissions affect mainly the employees and users of the stations.

b) Emissions of electricity production depend on the consumption of primary fuels and its associated emission factors and plant efficiency. Hence, for a same level of plant efficiency, the pollution rates will grow significantly depending on whether gas, oil, coal or lignite is used as fuel. In Uzbekistan, gas is by far the predominant source of energy, with more than 50% of the total energy production, before coal (20%) and hydroelectricity. (17%). Hydroelectricity is non polluting and the emissions of gas power plants are significantly lower than in oil power plants. In this context, and compared to other industrial countries where oil and coal are the main source of energy, we can assume that emission rates by rail transport from electricity generation in Uzbekistan are rather low.

It is thus possible to assert that, in Uzbekistan, electric trains are less polluting than diesel trains. In the Uzbek present energy context, using high quality fuels, and even with power stations with outdated technology, the final result is clearly in favour of electric traction.

As regards to pollution issues, electric trains and diesel trains differ also on the location and dispersion mode of the emissions. Hence, it must be noted that the introduction of electrification leads to the reduction of emissions affecting people in the immediate vicinity of railway lines. Instead, concern focuses on the power generating sources and their emissions, the nature of which (i.e. type, volume and geographical range) depends largely on the energy used for electricity generation and the dispersal mechanisms employed.

The elements given above on emissions by rail transport must not make forget that compared to road or air transport, rail is clearly demonstrated to be the cleanest mode of transport (lowest rate emissions/passenger-km).

At the UTY stationary facilities, specific filtering devices equip the chimneys. However, according to RSOCEP, less than 40% of all pollutants emitted by stationary sources is 'trapped' and rendered harmless.

In 1996, the total emission of UTY stationary facilities (mainly boilers) averaged 27.4 thousand tons of pollutants, while the quantity of pollutants emitted by mobile sources in 1996 was 5.44 thousand tons (excluding the pollution associated with the electric locomotives - through the power stations). This clearly shows the limited extent of the pollution generated by the mobile sources when compared to stationary sources at UTY. Among these stationary sources, the ones which may be the most polluting are the cement factories, and the sleeper factory. But most of the pollution comes from the heating of office buildings, workshops, or UTY institutes.

Apart from pollutants induced by fuel combustion, rail transport produces only marginal emissions such as cast iron brake block dust (during heavy braking, a fine iron dust is produced) or ozone-depleting chemicals used in extinguishers or in some engineering workshops.

14.4.2.2.3



#### Noise

Surveys and opinion polls in many countries showed that the disturbance most frequently cited by respondents is noise at home. The prime offending source of noise in terms of the number of people disturbed is usually road traffic, followed by neighbourhood and aircraft noise. In Uzbekistan, however, the population has not yet developed the same sensitivity to the problem of noise as in western countries. But in the medium or long run, with the progressive increase of people income and welfare, such disturbance will be felt increasingly.

The noise emissions from rail transport come mainly from the contact between the rails and the train wheels. On the old tracks of Uzbekistan, noise emissions are worsened by track imperfections, such as corrugations and dipped rail joints. Old rolling stock using iron block tread brakes roughen the wheel treads during braking, making vehicles noisy in station areas.

Noise problems have not been studied much in Uzbekistan and few data are available. Obviously, noise exposure levels are higher in urban areas - which are more densely populated and where traffic density is therefore higher - and exceeds the maximum allowable levels (given by the FSU Standard No 22283-88 on admissible noise levels in dwelling areas) all the more easily since the current regulation is about 10 dB(A) more stringent than the current legislation in western European countries.

The main effects of noise are both hearing damage and non auditory physiological effects. Noise is thus seen to be pathogenic; it is part of the vast category of factors contributing to stress, disorders of cardiovascular and digestive systems, and it affects the quality of sleep. The findings of the many studies undertaken in OECD countries on the effects of noise and its wider repercussions show that in order to comply with desirable limits for well-being indoors, the outdoor level should not exceed 60-65 dB(A) (Leq¹ by day). In the case of new residential areas, the outdoor level should not exceed 55 dB(A) (Leq by night).

Such maximum noise levels can be easily exceeded for dwellings located less than 200 m from the railway lines. Thus, using the Method for Noise Evaluation developed by the CETUR (1980), for a present traffic of 57 trains per day on Dzhizak-Marakand, half freight trains, at the average speed of 60 kph, the noise levels reach about 73 dB(A) at a distance of 50 m from the railway line, and still reach 67 dB(A) 200 m far from the line, in day time (assuming that 75% of the traffic occurs between 8 a.m. and 8 p.m.).

## 14.4.2.2.4 Water and Soil Pollution

With respect to water and soil pollution, it must be first pointed out that within the transport sector, as for air pollution, the road transport is by far more polluting than the rail transport.

In addition, one must add that, whatever road or rail transport, such pollution - linked with the contamination of run-off waters when flowing on the carriageways or tracks - is negligible in comparison with waste water coming from industry, sewage and agriculture.

Leq = Equivalent sound Level, in decibels, A weighted



### Water pollution

One usually differentiates seasonal pollution, accidental pollution and chronic pollution

### a) Seasonal pollution

The use of pesticides, weed-killers and growth reducers for maintenance of the tracks can be considered as a form of seasonal pollution. Nevertheless, in Uzbekistan, weed suppression is doe mechanically and thus does not generate any pollution.

### b) Accidental pollution

This is the pollution caused by spills resulting from accidents during transport, loading/unloading of goods or at the workshops, freight depots, ... The gravity of the consequences is variable: it depends on the nature and quantity of the spilt product, and also on the resource likely to be contaminated. A contaminated supply source may be unusable, sometimes definitively. The pollution of streams and ponds is often grave. The stake is thus ecological and economic at once.

Hydrocarbons are involved in the majority of cases. Their polluting power is considerable. They are not miscible with water and spread out on the surface. No terrain is really proof against them, their progress is only more or less rapid. Then the danger comes from toxic and corrosive matters. They are often soluble in water, which makes them irretrievable. Toxicity depends on their concentration in the environment.

In Uzbekistan, no accidental pollution has been officially recorded on the railway network, meaning not that no pollution occurred.

#### c) Chronic pollution

This covers all pollution resulting from traffic, maintenance and workshop activities:

- waste resulting from the combustion of fuels: hydrocarbons, lead, etc...
- oil and lubricant, leaking from trains (till 1985, diesel locomotives were not fitted out with sumps allowing to recover lubricant leaks).
- metal waste resulting from the corrosion of vehicles.
- mineral oils and greases used to lubricate point switches and track curves,
- discharge of effluents to watercourses and sewers (trains washing stations, sewage from public buildings or offices).

The pollutants spilt onto the tracks are transported outside the railway by the winds and run-off waters, resulting in contaminating the surroundings.

Train servicing and maintenance processes generate also effluents such as oils, antifreeze and cleaning chemicals which can pollute the environment if not carefully controlled.

In 1996, on the total amount of UTY's discharges, 2.21 million m³ was recycled, 0.261 million m³ was discharged without treatment, and 2.3 million m³ was treated (purified) before discharge. Hence, the wastewater treatment rate was supposed to be approximately 90%.

However, few information is currently available on the efficiency of the treatment devices. When visiting the Tashkent Locomotive Maintenance Depot, the Consultant noted that all contaminated run-off waters were collected and directed towards a settling basin, followed by a grease trap and a three stages physico-chemical treatment process. The UTY laboratory unit is supposed to perform daily analysis of the discharge quality, which is also controlled on a random basis by the State Committee for Nature Protection (SCNP).

According to the State Committee, the water treatment facilities of UTY are not effective, mainly because of lack of maintenance, and the discharges quality does not match the current regulations. The Khavaz station, with its extensive marshalling yard and maintenance workshop, is considered to be the most polluting UTY enterprise with respect to water pollution. Among the main pollution sources of the Uzbekistan rivers, the SCNP listed the Tashkent railways (polluting discharges in Bozsu Canal and then the Syrdaria River), and the Fergana marshalling yard (discharges into the Ahangaran River). In both cases pollution by oil products is mentioned. As to the groundwater resources, the railways are supposed to constitute a significant contamination source of the Chirchik valley, Kibray and other water intakes of the Tashkent area.

### Soil pollution

Soil pollution is linked with atmosphere and water pollution. Therefore, road transport is by far the main mode of transportation which generates this kind of pollution.

Polluting particles are transported by air and spread about at variable distances away from tracks (depending on winds), in the environment.

This form of pollution is mainly caused by heavy metals, PCBs, non-burnt hydrocarbons and dusts. Pollutants settle on the leaves of plants or are absorbed by roots. The pollution extent is directly related to the parking duration of trains. As a consequence, marshalling yards, sidings and freight tracks seem to be especially contaminated, and the main sources of contamination are probably locomotives. Outside stations, and on the main freight lines, the tracks are visibly soiled by leaks of petroleum products from tank wagons, but this pollution usually does not expand out of the railway right-of-way.

Even if they do not pollute sensu-stricto, certain commodities carried by rail in open wagons can produce dust, creating a nuisance for neighbours and for line side staff and passengers on adjacent platforms. When deposited on the track this dust also fills the interstices within the track ballast, impeding drainage. Hence, transport of sand, coal, lime, and limestone in open wagons is likely to generate dust fly.

## 14.4.2.2.5 Waste and Litter

Many different types of waste are produced by railway operators. These mainly arise from train, station or track maintenance processes.

Waste produced by railway operators usually include spent ballast, batteries, biological waste, cleaning chemicals, empty drums/containers which have contained chemicals, waste oils and fuels, paints, scrap metals, sleepers, recyclable materials,... Among these waste materials, some are especially hazardous for the environment such as batteries or waste oils. Batteries may contain highly toxic heavy metals (zinc, mercury, cadmium).



In Uzbekistan, one can note that the batteries life span is especially short (only about 3 years, to be compared with 6 years on average in western European countries). Waste motor oils and gearbox oils when discharged into the natural environment is seriously harmful to the oxygenation of soils and waters and is toxic for the fauna and flora. It must be noted that oil discharged into a waste water treatment network causes grave problems at the level of the treatment plant.

According to UTY environmental directives, it is understood that such waste materials are collected, transported and eliminated in accordance with the requirements of the competent agencies. In particular, it is understood that waste oils are recycled at the Railways facilities.

In volume, spent ballast and old sleepers constitute the main waste. The old ballast is sometimes disposed of on both sides of the railway terrace, or deposited in specific areas in accordance with the concerned municipalities. However, usually the old ballast remains on the tracks and are only covered by new ballast. Worn timber sleepers are sold, most often to the railway employees, as fuel or construction material. It must be recalled that timber sleepers are creosote treated.

In the Uzbek context, the sawdust used to collect the oil and grease leaks and spills in depots and workshops, seems to constitute considerable volume of waste. Though heavily contaminated, this waste is supposed to be disposed of in common landfills.

The last category of waste coming from railways activity is litter. Litter discarded by customers and the general public on railways and on trains has a real visual impact and can turn in safety hazard (fire hazard). Refuse and debris on tracks encourage people to drop more rubbish. On that standpoint, the Uzbekistan railway stations are rather clean.

## 14.5 Key Environmental Issues of the Restructuring Process

# 14.5.1 Nature of the Project Components likely to Induce Environmental Effects

The following project description is mainly based on the PADECO - JTC propositions. These propositions are completed by new recommendations for the network electrification.

### 14.5.1.1 Replacement of Tracks

The replacement of tracks should be carried out for the critical sections, i.e. those which have speed restrictions of less than 60 kph, and represent 708 rail kilometres of rail replacement (350 track kilometres). Most of the works will occur on the Silk Road route and, in a limited extent, on the Khavast-Ferghana-Andijan railway sections.

The project consists of procurement of rails, sleepers, track materials and machinery.

Nearly half of track replacement needs are located on the Chengeldy-Tashkent-Khavast section (341.4 rail km). Beside this section, the works mainly focus in Navoi, Khojadavlet and Andijan areas.

### 14.5.1.2 Railway Electrification

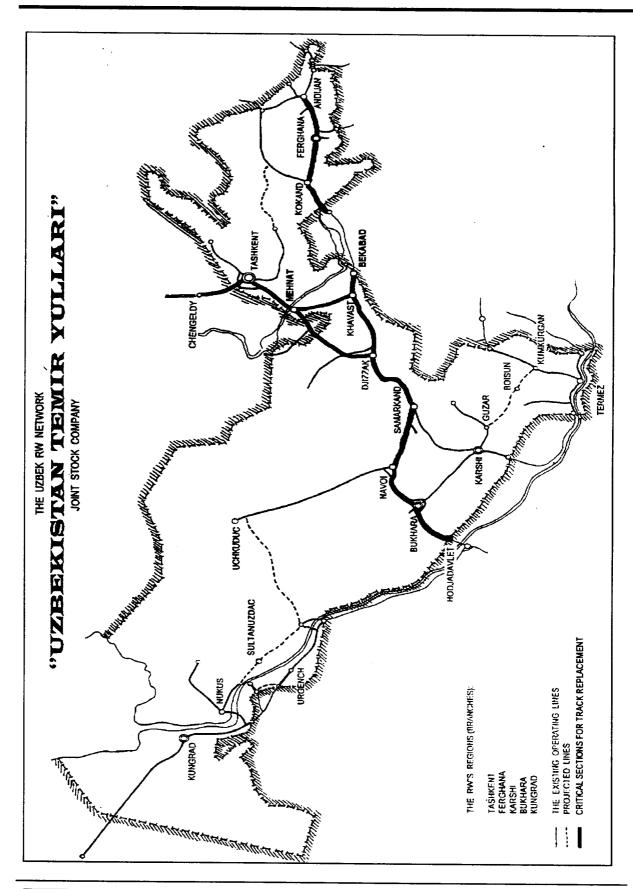
The priority railway sections which deserve electrification are Mekhnat-Dzihzak (120 track km) and Djambaï-Marakan (32 track km).

The electrification works will also include the erection of five sub-stations.

## 14.5.1.3 Changes in Operation, Maintenance and Manufacturing Practices

In the framework of the restructuring project, it is planned:

- to replace part of the rolling stock,
- to procure the minimum tools and machinery required for track maintenance,
- to ensure a sufficient supply of concrete sleepers for track maintenance by improving the Akhangaran sleeper factory's production process, material supply and sleeper design,
- to replace old and worn-out flash-butt rail welding machine and to renew the equipment for building up by welding on manganese crossing.



# 14.5.2 Main Environmental Impacts

The impact description will be dealt with by comparison with the present level of impact on the lines subject to the restructuring project. Therefore, the general points already presented in section 14.4.2. will not be repeated.

Mitigatory measures corresponding to these impacts are described further in section 14.7.

# 14.5.2.1 Impacts related to the Future Infrastructures

## 14.5.2.1.1 Land Consumption

Theoretically, there will be no additional land take generated by the replacement of tracks, since it is not planned to build new railway alignment.

In fact, the track replacement should be accompanied by some measures aiming at improving the safety or commercial speed of the lines, such as:

- creation of over-passes for the replacement of some level crossings,
- widening of the railway platform in cut sections for improving the drainage pattern,
- creation of minor realignments for some sharp curves,
- construction of new platforms in some of the stations,
- installation of new signalling and power supply equipment.

On the whole, the project will induce the additional consumption of only few hectares of land, that is assumed to be negligible.

## 14.5.2.1.2 Impacts in Rural Environment

Impacts on the Physical Environment

No change of the vertical alignment of the railway lines is planned. Consequently, the project will not damage neither the microclimatic conditions, nor the drainage pattern of surface waters and groundwater.

Impacts on the Natural Environment

The railway infrastructures to be renewed are reported to not cross any protected natural area. No change in the severance effect is expected.

On the Mekhnat-Dzihzak and Djambaï-Marakan sections, the electrification of the line will add to the animal mortality caused by the traffic.

The train speed being slightly increased on the whole renewed lines, the collision risks will also increase. Nevertheless, if we consider that traffic flows will not evolve much in short or medium run, the effect will not be sensitive.

As to the vegetation, the future traffic staying at a relatively low level, the nearby vegetation will not suffer more from the induced pollution.



### Impacts on Land Use

No additional substitution effect or barrier effect will be felt by the nearby land users.

## Impacts on Landscape

The project will not create significant impacts on the present landscape, owing to the absence of changes in the vertical alignment of the railway lines and the minor changes occurring in the horizontal alignment.

The impacts will concentrate on the Mekhnat-Dzihzak and Djambaï-Marakan sections, with the installation of overhead systems.

## 14.5.2.1.3 Impacts on Spatial Organisation

The project will allow to reduce in some extent the travel times for express trains. It will thus facilitate population flows, especially between big cities. As such, the rehabilitation of the concerned railway lines may accentuate the imbalance between the economic cores and the small towns, and may participate to the phenomenon of rural desertification.

The project will not bring sufficient changes to influence the urban evolution of the municipalities.

# 14.5.2.2 Pollution Generated by the Operation of the Rehabilitated Lines

## 14.5.2.2.1 Traffic Forecasts on the Rehabilitated Lines

According to the new forecasts for the medium run (2007), the passenger traffic will keep its present level, assuming that part of the future needs will be transferred towards the road transport sector, as it can be seen currently in central European countries. For the freight traffic, in the most optimistic hypothesis, a 72% growth is expected by the year 2007, owing to probable rise in petroleum products and coal transportation. However, even in such circumstances, the traffic level on the busiest sections will stay relatively low (less than 80 trains per day)

Therefore, on the whole, the impacts related to the project operation will not change much with respect to the impacts already identified in section 14.4.2.2.

## 14.5.2.2.2 Energy Consumption and Air Pollution

With the additional electrification of some railway sections, the project will improve the energy efficiency of the rail transport in Uzbekistan and, by the same time, it will decrease the air pollution. Hence, the share of electrified lines will grow from 16% to 20% of the network.

#### 14.5.2.2.3 Noise

With respect to noise levels, the project components are likely to induce the following effects:

- the increase of the train speed will generate a worsening of the acoustic environment (growth of noise levels),
- the traffic changes will lead in a slight increase of the noise emissions (by approximately 1 dB(A)),

- the track rehabilitation should induce a noise reduction of minimum 4 dB (noise abatement measured in the framework of the E-20 modernisation project in Poland),
- the rolling stock modernisation or replacement by more modern ones will generate a positive effect (noise level decrease from 5 to 10 dB according to the type of rolling stock).

On the whole, and taking due account of the previous factors, the project should result in an improvement of the acoustic climate - by 4 or 5 dB - alongside the rehabilitated track sections.

### 14.5.2.2.4 Water and Soil Pollution

Regarding water pollution, the project will have no effect on the seasonal pollution (use of pesticides, weed killers,...) and will decrease the risks of accidental pollution and chronic pollution.

Aspects dealing with accidental pollution are addressed further in the report (section 14.6). In brief, one can say that the probability for accidents will decrease, because of the combination of several factors:

- the replacement of the old tracks and ballast,
- the improvements of signalling and telecommunication equipment.

For a slight improvement of the operation speed, the rehabilitated lines will thus beneficiate from significant improvements in the technical design of the infrastructure and so will gain in safety.

Chronic water pollution and soil pollution will be diminished by the electrification of the railway lines on the Mekhnat-Dzihzak and Djambaï-Marakan sections. On the whole line, PCBs and other toxic components should be lessened because of the progressive change in the present rolling stock by new materials (especially locomotives) and the replacement of electric transformers by new ones devoid of PCB.

Let us note that the main aquifers used for water supply and irrigation are in quaternary and neogenquaternary formations, and generally have depths of 100 to 150 m. Hence, they are on the whole well protected against either accidental or chronic pollution.

#### 14.5.2.2.5 Waste and Litter

Usual waste and litter produced by railway transport are tightly linked with traffic. Given that the traffic on the railway network is not supposed to grow much in the coming years, the overall volume of waste will not significantly change.

Nevertheless, the line rehabilitation will involve the replacement of old rails, spent ballast and old sleepers. These aspects are dealt with in section 14.5.2.3.

#### 14.5.2.3 Impacts during the Works Period

### 14.5.2.3.1 General Points

These impacts are often considered to be important and form a transitory hindrance for everybody near the railway (because of diversions, movement of construction plant, noise, dust, etc.). However this will be limited to the construction period and can be reduced by the taking of simple precautions which should be laid down in the specifications for the bidding contractors.



The works period may include several different operations such as establishment of base camps, rehabilitation of some stations, preparatory works and earthworks, civil engineering structures, removal of the existing track and replacement by a new track (ballast / rails / sleepers / OHS), installation of signalling (telecommunication equipment), and electric sub-station (on the electrified sections).

Within the planned rehabilitation works, the main operation will be the track replacement. Moreover, it is usually the most detrimental one on an environmental standpoint. So, the impact assessment will focus on it.

Most of the works will be performed by specific machines moving on the track itself in "quick succession". In addition to the quickness of the process (usually 400-500 m/j), it does not require work tracks since the access is provided by the railway track.

#### 14.5.2.3.2 Waste Production

Track replacement operations are first characterised by the production of a considerable quantity of waste:

- several 10,000 m³ of ballast,
- about 1,400 km of rails, and
- several thousands of timber or concrete sleepers.

Part of the old ballast should be reused for terrace widening or for the strengthening of the platform shoulders. The rest will be stockpiled on the railway side or given to the municipalities for various purposes.

The pollution level of the ballast being, on the whole, not worrying, no specific impact should be induced by their disposal. Nevertheless, in the biggest stations and above all in the marshalling yards, the ballast pollution may be high enough to deserve specific attention to the future disposal site.

Rails are made with very hard steel (high quality) and cannot be reused as scrap metal. They will probably be used for the refurbishment of sidings and secondary railway lines.

The old timber sleepers are usually sold or given as firewood. Knowing that they are treated with creosote, their burning can generate toxic smokes. However, the number of timber sleepers to be replaced is very low. In fact, the main lines of the railway network include only 18.3% of timber sleepers.

As to the concrete sleepers, they are usually crushed to be included in embankments for the construction of sidings or used for the refurbishment of secondary railway lines.

### 14.5.2.3.3 Procurement of New Materials

The track components that will be disposed off will be replaced by new materials to be procured. This procurement is in itself a source of environmental impacts resulting from the manufacture, the production and transport of these materials. In most cases such effects are likely to be those associated with any industrial operation, including gaseous emissions, noise, consumption of energy and natural resources, production of solid and aqueous wastes (some of which may be hazardous).

Manufacture and production are likely to take place at existing facilities, some of which may be remote from the rail network and may carry out a wide range of other activities.

In the present case, the procurement of new track components is likely to involve the following impacts:

- new ballast: development of new or existing quarries (Ziadin and Jumurtau), with associated disruption of land use, loss of habitat, visual intrusion, ...
- rails and sleepers processing: extraction of raw materials and associated impacts, noise, energy use, air pollution, ... The project recommendations include the improvement of the production process of the Akhangaran sleeper factory. The new proposed process (late or instant demolding system) is assumed to be more powerful, less requiring in raw material and less polluting than the present « short bench » system. For instance, it will allow to reduce the consumption in cement by about 20%. The new rail welding process will make no difference on an environmental standpoint.
- transport and storage: noise, dust, vehicle traffic, ...

It must be emphasised that all the required materials can be extracted or manufactured in the project area. Moreover, these materials will be transported by rail, which is a more environmentally friendly transport mode than the road.

The removal and replacement of the track materials bring also a trail of impacts among them noise produced by the machines replacing the ballast, which is particularly high. Vibration levels and dust generated by this activity have also strong potential effects, above all in Uzbekistan, because of the high level of dust deposit. But these impacts largely depend on the sensitivity of the surrounding environment: low in rural environment, high in urban environment. Hence, most of the works being implemented far from dwelling areas, the disturbances will be minimised.

# 14.6 Transport of Dangerous Goods and Safety Issues

# 14.6.1 Transport of Dangerous Goods

## 14.6.1.1 General Points

Transport of dangerous goods is a special issue linked with safety as well as the environment. As such, it is a very complex aspect which is impossible to address in detail within the present study.

Complete and reliable information about transport of dangerous goods is often lacking, even in OECD countries. In western countries, road is the first mode of transport for dangerous goods over short and medium distances. The transport of dangerous goods is prohibited on a few transport routes, mainly with tunnels, and some important corridors.

Accidents involving dangerous or polluting goods, including dangerous biological agents, genetically modified organisms or micro-organisms, are rare but can cause major environmental damage if these goods are discharged into the environment. The damage depends upon the nature, characteristics and volume of the substances thus released. Generally most of the transported dangerous goods are hydrocarbons.

Half of accidents involving transport of dangerous goods occur during loading/unloading operations. Accidents may also happen in transit, maintenance or storage installations. Many of these installations are submitted to the requirements of "listed installations" for environment protection, in order to provide optimal safety conditions.

Transport of dangerous goods is a complex problem which involves many ministries: transport, but also industry, environment, internal affairs, equipment, health, labour, foreign affairs. It concerns numerous people: road transport companies, local politicians and police, and a very sensitised public. It is often a cross boundary traffic requiring internationally approved regulation and needing a co-operative approach to the development of optimal solutions.

### 14.6.1.2 The Uzbek Context

In Uzbekistan, railway transport is used to convey nearly all dangerous products which are mainly hydrocarbons ( $\approx 70\%$ ), phosphorous products, ammonia, chlorine, acids, used for industrial purposes and chemicals used in agriculture (pesticides, fertilisers).

The main railway route used by this kind of traffic is by far the Silk Road route.

Nearly all the dangerous goods are transported in tank wagons. These wagons are on the whole outdated and worn-out, so it is assumed by the Railways personnel that 40% of them should be replaced.

However, as far as people remember, no major incident involving transport of dangerous goods has occurred on the railway network, except small leaks on wagons, but without any serious consequences. The main reasons evoked for these incidents are usually the poor condition of tracks, but also the deterioration of wagons, faulty traffic lights and human factors (e.g. violation of discipline and inattention).

### 14.6.1.3 Control and Surveillance

Numerous conventions and international agreements rule the international transport of dangerous goods.

In the rail transport sector, the International Regulation concerning transport of dangerous goods by railway (RID)² dates back to January 1, 1983, the date of coming into force of the international convention for the transport of goods by railway (CIM).

The content of the RID convention deals mainly with:

a) type of dangerous cargo, with notably the definition of 9 classes of dangerous goods,

Règlement International concernant le transport des marchandises Dangereuses par chemin de fer



- b) packing requirements, the labelling of dangerous goods and the establishing of related documents,
- c) the way transport equipment must be built, provided with complementary devices and tested,
- d) the signs to be borne on the transport equipment,
- e) the precautions to be taken in loading, unloading, and storage operations.

Though the Consultant was not given any accurate information in this field, it is understood that Uzbekistan did not joined the RID convention yet.

The regulation in force is still an outdated, less stringent regulation, still in force in FSU countries. Compared to RID, the classification of dangerous goods is approximately the same, except for infectious materials (ranked with radioactive materials). It seems that packing and marking requirements differ little between the Uzbek regulations and international conventions, but the codification used is completely different, apparently for previous "geopolitical" reasons. The list of dangerous goods defined by UNO is currently used by the Uzbek authorities. There is a list of goods whose import into Uzbekistan is prohibited. This list contains some dangerous goods such as forbidden pesticides (DDT).

The control and enforcement of the regulation on transport of dangerous goods seems to be rather effective and efficient, knowing that as far as people remember, no death or injury involving transport of dangerous goods by rail has been to deplore.

# 14.6.1.4 Impact of the Railways Rehabilitation on the Transport of Dangerous Goods

At present, the Silk Road route cannot be considered hazardous concerning the transport of dangerous goods, owing to the low share of dangerous goods transported and the absence of major incident in the past and present times.

In the future, this kind of transport should however increase, because of foreseeable development of the industrial activities. Provided that railway rehabilitation is implemented, the probability for accidents will decrease, because of the combination of two main factors:

- the replacement of the old tracks and ballast.
- the improvements of signalling and telecommunication equipment.

For a slight improvement of the operation speed, the rehabilitated sections will thus beneficiate from significant improvements in the technical design of the infrastructure and so will gain in safety.

We can even assume that - in long term - the rehabilitation project will be the main way to secure the transport of dangerous goods on this railway line.

### 14.6.2 Other Safety Issues

UTY counts more than 200 specific enterprises, each of them being likely to present varied safety issues. It is not our purpose here to get a comprehensive view of the situation, but more to address what appears - in the limited time of the study - to be the most acute problems.

During the Consultant's visits to several railway stations and journey on the Djizzak-Mehnat line, the main identified safety problem was the uncontrolled crossing of numerous pedestrians (sometimes with heavy burden) and livestock in stations as well as on the line. These « wild » crossings can be found everywhere along the lines, but are obviously more frequent in dwelling areas. Children roaming on the tracks with few cattle are often seen, and it seems that the tracks are also used for short distance trips between villages. Though the locomotives announce their coming by sounding their horn, people wait till the last time before moving from the tracks.

The present hazardous situation will worsen with the railways rehabilitation, because of the increase in train speed, if no preventive measures are taken.

A visit in the Tashkent Locomotive Maintenance Depot has been used to assess how safety issues are tackled in UTY industrial units. It allowed to notice that safety instruction signs are placed in each room of the workshop and that especially hazardous areas are confined by adequate fencing. On the other hand, it has been seen that safety equipment (extinguishers, sand-buckets, shovels, ...) often lack or are stored in locked cupboards. This situation is reported to result from thefts by UTY employees.

## 14.7 Proposed Mitigation Measures

## 14.7.1 Purpose

This section describes the measures and procedures which must be implemented to contain or manage the environmental effects likely to result from the restructuring process.

The measures to be taken are under the responsibility of UTY who commits himself to perform them.

It must be pointed out that the measures presented in this part are only general provisions which will deserve to be refined when detailed environmental impact assessment will be performed, at the design stages.

No part of the project must be authorised or commenced until the mitigation appropriate to it has been adopted.

## 14.7.2 Preliminary Environmental Inspection of the Critical Sections

The precise definition of the mitigation measures will be possible only after a preliminary identification of the environmental sensitivity in the vicinity of the works. The preliminary environmental inspection (PEI) will allow key issues to be identified and attention to be focused on the impacts and mitigation likely to be associated with them.

The PEI will be performed on all sites on which works forming part of the restructuring process will take place, and which are under direct railway control, in particular the following:

- sections of rail corridor along which rehabilitation work will occur,
- ballast quarries.
- Akhangaran sleeper factory,
- waste disposal sites.

While carrying out the PEI, specific attention will be paid to the presence of environmental sensitive components and to the possible impacts of the project on these components, such as: dwelling areas, community facilities (e.g. schools, hospitals), recreational areas, tourism attractions, historic buildings, shallow aquifers, watercourses, wetlands, steep slopes or over erosion prone areas, natural protected areas, ...

The PEI should be carried out by RSOCEP personnel on behalf of the design team, in close coordination with regional agencies of the State Committee for Nature Protection.

# 14.7.3 Measures related to the Rehabilitated Lines Operation

#### 14.7.3.1 Introduction

Basically, as seen in section 14.5.2.2, no significant additional impact will result from either the rehabilitated infrastructures or their operation. Hence, the following measures must be considered as « accompanying measures » of the project more than mitigation measures sensu-stricto.

Such accompanying measures are not compulsory regarding Uzbek regulations, but is currently widely admitted in the most developed countries that environmental issues linked with existing transport infrastructures should be reduced or suppressed when implementing rehabilitation or upgrading works of these infrastructures. This approach ensues the necessity to progressively suppress the environmental « black areas » alongside the road and railway networks.

Two categories of measures - related to what appears to be the main environmental impacts of Uzbek railways - will be dealt with in this section:

- reduction of noise and vibration,
- reduction of water and soil pollution.

#### 14.7.3.2 Reduction of Noise and Vibrations

Field visits performed by the Consultant suggest that in many dwelling areas alongside the Silk Road railway line, the permissible noise levels are presently exceeded and will be in the future, regarding the Uzbek legal requirements as well as the norms used by European Union countries.

It is assumed that the installation of noise protection devices will not be expensive if carried out during the rehabilitation works, thanks to «scale savings» allowed by the presence of suitable manpower, building sites, material supply, etc.

According to the situation found in the field, the following anti-noise protection devices should be implemented:

Type of measure	Type of location	Ригрияе	material	Indicative unit cost in ECU (under EU standards)	•
noise barrier	at the source where no space available for noise bunds	noise reduction in urban areas	concrete (panels and posts)	≈ 150 / linear metre for a 2 m high barrier	see comments
noise bunds	at the source where space permits	noise reduction in rural areas	earth	from 5 to 15/m ³ according to haulage	see comments
building insulation	at the receptor	noise reduction for multi-storey building	window frame upgrading and double-glazing	from 150 to 600/window	from 30 to 40 dB(A)
anti vibration sole	at the source	vibration reduction in urban areas	rubber and thermoplastic compounds	≈ 300 / linear metre	from 3 dB(A) at 63 Hz to 12 dB(A) at 80 Hz

### Comments:

- Noise is mitigated most effectively as close as possible to its source. Once noise is released into
  the environment, it can be mitigated only at the point of receipt, i.e. the affected building; such
  mitigation is less effective and can involve a large number of receptors. Outdoor areas such as
  gardens cannot be mitigated, and open windows compromise the effectiveness of insulation.
- The key criteria for noise barriers are the density of the material of which the barrier is constructed, and the degree to which barrier height increase the distance over which noise must travel to receptor. The barrier height must be calculated according to the noise abatement sought out. There are many construction materials used for noise barriers; is given here the least expensive one. The noise barrier efficiency depends on the barrier height and the respective location of the barrier in relation to the noise source and receptor location.
- Noise bunds are generally more cost-effective than barriers. Moreover, their visual integration is generally easier than for barriers. The principal cost variable, apart from the size of bund, is the distance over which the spoil of which it is to be formed must be transported. The noise bund efficiency depends on the bund height and the respective location of the bund in relation to the noise source and receptor location.
- It is emphasised that UTY has the full capability for manufacturing and installing noise barriers (concrete made) and earth bunds, thus minimising the costs and facilitating the implementation.
- Building insulation should be used only when the building vicinity would require noise barriers of
  more than 3-4 m high. It is assumed that such situation will be seldom found alongside the Silk
  Road route. Building insulation is generally much more expensive than noise barriers and noise
  bunds. Given the cost and the low efficiency of that device on old or spoilt building façade, it
  should be used only for recent constructions.
- Anti-vibration soles are put beneath the track where vibration levels are likely to create significant damages to buildings or disturbances to the dwellers. These devices could also be used to reinforce the effect of noise barriers.

## 14.7.3.3 Reduction of Water and Soil Pollution

### 14.7.3.3.1 General Measures

The risk of contamination of watercourses and aquifers may be mitigated by:

- Improvements to maintenance and design of rolling stock (e.g. through reducing incidental spillage of oils etc., introduction of carriages with sealed sanitary systems).
- Improvements to track maintenance (e.g. through selection of lubricants and de-icers).
- Incorporation of measures such as oil and silt traps, settling ponds and impermeable membranes in track infrastructure, and
- Improvements to liquid waste management and facilities at workshops, depots and stations (e.g.
  through segregation of sanitary and non-sanitary flows, raising employee awareness, installation
  and maintenance of efficient wastewater treatment and oil recovery systems).

## 14.7.3.3.2 Specific measures for the Protection of Aquifers

Accidental pollution, especially when involving transport of dangerous goods, is a major threat regarding the protection of aquifers.

The Silk Road route runs through areas of main underground water reservoirs and other areas where the railway line may enter in conflict with the groundwater protection principles.

Considering that the underground water pollution is sometimes everlasting, and that the self-cleaning processes occur very slowly, preventive means should be undertook in the sensitive areas, which would make the contamination migration to aquiferous layers impossible.

These preventive means could be general drainage protection works incorporated in the design of the railway infrastructure:

- waterproof ditches and interceptor drains,
- retention ponds,
- groundwater protection using geotextile and sand layer,
- groundwater protection using UPVC membrane.

The cheapest measure would consist in the waterproofing of the railway terrace and lineside ditches by the implementation of compacted clay layers. In case of lack of clay material in the study area, it is recommended to use geosynthetic clay liner such as Nabento® (manufactured in Germany). It is a composite in which bentonite (special clay of very low permeability) is sandwiched between two layers of stitch-bonded fabric and supplied in roll form.

The cost of waterproofing the railway terrace can be estimated at about 8 ECU / m² either with the use of compacted clay layer (minimum 60 cm thick) or the use of geosynthetic liner, by EU standards. It could be significantly cheaper if clay materials are available in large quantities in the vicinity of the railway line.

Both techniques could be implemented by UTY's staff without external assistance.

### 14.7.3.3.3 Specific Measures for the Protection of Watercourses

Roughly, groundwater and surface waters are sensitive to the same pollution sources. Hence, polluted rivers can contaminate associated aquifers. Therefore, every measure aiming at the protection of surface waters also acts as protective measure for groundwater.

According to the present water quality and the hydrobiological potentialities of the watercourses crossed by the railway line, one should first identify those which deserve maximal protection.

As for groundwater, the main protection device will be the waterproofing of the railway terrace, then the collection of run-off water by waterproof ditches towards settling basins equipped with oil traps, before the final discharge in rivers. The need for regular maintenance of these devices is pointed out.

### 14.7.4 Measures related to the Works Period

Below are given some environmental specifications to be included in the overall Technical Specifications in order to improve environmental protection during the execution phase.

### 14.7.4.1 Organisation of the works

The engineer responsible for supervision of the works will ensure that all the mitigation and compensatory measures planned in the project are performed. He will also handle the relations between the different categories of users and residents in the project implementation area to take into account their problems during the works.

# 14.7.4.2 5.4.2. Measures related to Track Replacement and Railway Electrification

In order to reduce the impacts to neighbouring dwelling houses, the measures below will be adopted:

- As regards to noise issues, prior to commencement of the work, UTY will be required to submit the following:
  - a method statement describing the type of plant to be used and the noise control methods proposed,
  - a work programme indicating the sound power level and location for each activity,
  - manufacturers' literature establishing the sound power level of plant, and
  - calculations of Laeq and maximum levels at specified locations as may be required by the relevant authorities.

This work will be performed by the RSOCEP.

Hours or working will be subject to the relevant authorities agreement. This should normally exclude night-time working in sensitive locations (e.g. close to housing or hospitals).

There do not appear to be any local regulations concerning work plant noise levels. The degree of noise nuisance depends to a considerable extent on the condition of the plant and the quality of maintenance. The first measure to be applied is the careful soundproofing of engines.

- UTY will take all reasonable measures to avoid creating a dust nuisance and to prevent emissions of smoke of fumes from plant or stored materials (e.g. fuel oils).
- UTY will take all reasonable measures to control vibration so as to comply with any regulatory requirements, to protect receptors from nuisance or discomfort and to protect buildings from damage.

With respect to the waste generated by this work phase (ballast, rails, sleepers,...), specific measures will be implemented for their disposal or reuse:

- Prior site investigations will be carried out on any areas which are known or likely to contain contaminated materials. The excavation, handling and disposal of those materials will have to be carried out in compliance with the best practices, regulatory controls and agreements with relevant authorities.
- All waste will have to be handled and transported in a safe and environmentally responsible manner. Waste contractors and hauliers will be licensed or will otherwise be able to demonstrate an adequate degree of competence in complying with this requirement. A consignment note system or equivalent shall be adopted, enabling waste to be tracked to its final destination.

- All reasonable opportunities will be sought for the recycling of waste arising from the project. UTY will have to submit a Recycling Plan which shall specify the types and quantities of waste to be recycled, the proposed method of recycling and the end-use to which the recycled product will be put.
- Sites or facilities used for the disposal of waste from the project:
  - will be licensed or otherwise approved for that purpose (especially for contaminated material),
  - will have an acceptable record of health, safety and environmental performance,
  - will have been designed specifically for their intended waste disposal purpose,
  - will incorporate appropriate environmental mitigation (e.g. leachate control on landfills; cleaning and venting of combustion emissions on incinerators), and
  - will be managed in an environmentally responsible manner, including documentation of activities and emergency response procedures.

## 14.7.5 Measures related to Rolling Stock Replacement

Using new diesel locomotives or electric locomotives will - in both cases - help to reduce air pollution as well as oil or lubricant leakage on the track.

As to the remaining pollution associated with railway transportation (cast iron brake block dust, ozone depleting chemicals), it does not represent a significant issue and can be mitigated through the implementation of the following measures:

- the use of disk brakes for rolling stock and high phosphorous iron blocks (reduce brake wear and cut the amount of iron dust produced),
- the replacement of ozone-depleting chemicals (Halons, CFCs, Trhichloroethane) found in fire extinguishing systems, clearing and degreasing components,...

Noise emissions can be minimised by the use of rolling stock which uses disk brakes with a body profile that is aerodynamically smooth. The wheels will be regularly inspected to detect flats. For new trains, low engine noise levels are generally incorporated in design specifications, together with automatic engine shut-off after a predetermined period.

### 14.7.6 Safety Measures

Regarding transport of dangerous goods, the main measure to be implemented is the adoption of the RID Convention for domestic transport and international transport towards other FSU countries. The RID convention being already used for the transportation of certain commodities towards western countries, it is just a matter of extending it to all transport of dangerous goods. The transport conditions will become safer, assuming that the current FSU regulation is more lenient.

Some exemptions or adjustments of the RID requirements are possible, by bilateral or multilateral agreements. This could be the case for Uzbekistan, for which strict enforcement of the international conventions could pose material and financial problems, due to the considerable investments needed. In particular, some products could be removed from the list of dangerous goods, at least temporarily.

However, decisions related to transport of dangerous goods does not depend on the railways authorities: it has to be decided at an interministerial level. Furthermore, actual means will have to be given for an effective enforcement of the regulations.

As to other safety issues, within UTY enterprises, the following is advised:

- On each section to be rehabilitated, pedestrian paths will have to be provided on both sides of the railway terrace, in order to prompt people to not use the tracks for their travelling. Livestock wandering along the tracks should be prohibited.
- Thorough safety expertise should be carried on for each industrial unit of UTY by an independent organism. Such expertise could last approximately one day per site and is assumed to amount to about 10,000 ECU if international consulting is required.

## 14.7.7 Reinforcement of the RSOCEP means

Given that the Railway Scientific and Operational Centre for Environmental Protection will be entrusted with the implementation and the follow up of most of the previous measures, it appears necessary to supply them with the necessary tools for carrying out these activities as well as their current duties.

Basically the Centre is already well provided in competent personnel and its collaboration with the different UTY structures and enterprises seems to work well. Hence, it is assumed that no changes are required in these fields.

However, needs have been identified in both training and - above all - equipment. More precisely these needs concern:

- Training: 2-3 days training course on Internet intended to facilitate the research of international sources of information regarding environmental issues and ecological regulations and legislation (approximate cost = 5,000 ECU).
- Equipment:
  - Two multi-media computers and software's such as latest versions "Vega", "Atmosfera", "Hydrosfera", "Ecolog", developed by Russian specialists (≈ 7,000 ECU).
  - One mobile lab to carry out air pollution and water pollution analysis (such labs are manufactured in Mukachevo, Ukraine). Approximate cost = 20,000 ECU.
  - One 4W drive car (≈ 15,000 ECU for a FSU brand).

# 14.8 Environmental Management Action Plan

At the time of the writing of the present Environmental Review, no completion date was defined for the several components of the restructuring project. Thus, actual action plan cannot be defined yet, and only indicative information on the mitigation measures completion are given.



The following table sets out the main components of the Action Plan, together with their costs and the indicative deadlines by which they will be completed. Some comments about the costing approach are given afterwards.

Project component	Nature of the measures	Cost in ECU	Indicative deadline
All types of work included	Preliminary	1,000	completion of design
in the restructuring project	environmental inspection (PEI)		works
Track replacement	Reduction of noise emission and water pollution	≈ 2% of project total	works phase
Track replacement and railway electrification	Measures related to the works period	no significant extra cost	works phase
Rolling stock replacement	Rolling stock with higher environmental performances	no significant extra cost	renewal of the rolling stock fleet
Changes in operation, maintenance, and manufacturing practices	Safety measures	10,000	could be completed at once
UTY restructuring	Reinforcement of the RSOCEP means	42,000	should be done at once

#### Comments about cost estimates:

- The preliminary environmental inspection and most of the environmental studies included in the measures related to the works period should be carried out by the RSOCEP. Hence, given the current rates of salary (about 6000 cym / month for UTY's employees on average) these studies cannot be considered as significant expenses. Furthermore, the environmental assessments which will be performed ensue legal requirements regarding Uzbek legislation. So, the corresponding costs will not form additional costs with respect to the project total cost (it should be already included in the overall design costs).
- For the reduction of noise emission and water pollution, no accurate estimates could be given without precise environmental investigation to be done in the framework of the PEI. A detailed cost estimate has been recently performed by the Consultant on a 163 km railway section in Poland (E-30 line, between Wroclaw and the German border). This project consists in the rehabilitation of the E-30 line according to EU standards. The traffic level on the E-30 is significantly higher than on the Silk Road route, as is the population density alongside the railway line. In this context, the suppression of the environmental black areas has been estimated to amount 2% of the total cost of the project. Given a less restricting context, in Uzbekistan this figure should not be exceeded.
- The measures related to the works period should not induce extra costs, insofar as they are
  mainly organisational measures or legal measures likely to be integrated within any railway
  project, as such as the PEI.
- Some rolling stock replacement is included in the restructuring project. It is assumed that the new
  locomotives and wagons will be fitted with most of the required environmental improvements
  without additional cost.

#### 14.9 Abbreviations

EAP Environmental Action Plan

ECU European Currency Unit

EIA Environmental Impact Assessment

EU European Union

FSU Former Soviet Union

IEE Initial Environmental Examination

PEI Preliminary Environmental Inspection

RID International Regulation concerning Transport of Dangerous Goods by Railways

RSOCEP Railway Scientific and Operational Centre for Environmental Protection



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Annexe 1

# Main Environmental Norms and Standards

The allowable concentration of pollutants in ambiant air is given by the FSU standard n° 3086-84 of 27/08/1984.

The limits for the transport sector main pollutants are given in the following table.

Pollutants	Limit value (µg/m3)	
0-1	Instantaneous maximum	Daily average maximum
Carbon monoxide (CO) Niltrogen oxides: NO ₂	5 000	3 000
NO	85	40
Lead (Pb)	600	60
Sulphur dioxide (SO ₂ )	500	0,3
Aldelydes	15	50
Particulates (according		15
to the composition)	150 - 500	50 - 150

The comparison with EEC standards are not easy because the periods of references are not the same. However, EEC admissible levels are much more restraining concerning CO emissions while being more tolerant with the other pollutants. We can note that there is no guide values in FSU standards.

**Noise limit levels** and methodics of measuring are given by the FSU standard n° 22283-88. Permissible levels of noise are assessed according to the spectral (wide-band noise, tonic noise) and time (steady noise, swaying noise, interrupting noise, impulsive noise) characteristics.

The main figures of this standard are the following:

Type of building	Spectral characte- ristic	Maximum noise level (dB(A))	Leq dB(A)	Period of the day
Residential buildings *	В	70	55	7-23
(including retirement houses		60	45	23-7
+ rest centers)	Т	65	50	7-23
		55	40	23-7
Rest areas within	В	60	45	-
residential districts	Т	55	40	-
Hotels *	В	75	60	7-23
		65	50	23-7
	T	70	55	7-23
		60	45	23-7

 ² m in front of the façade

Railways generate tonic noises, but according to the amount of traffic, roads generate tonic or band noises.

We can note that these figures are restricting regarding to western countries limits for roads or railways infrastructures. The FSU regulation is about 10 dB(A) more demanding than current legislation in EC countries.

FSU Standards No 1166 of May 16, 1974 and 120411 of August 9, 1990 define the limits of **permissible concentrations of harmful materials in river water** for drinking, fishing, agricultural and industrial use.

In relation to regulations in western countries, these standards are very stringent and raise again the problem of effective enforcement of these standards. The same comment applies to FSU Standard No 4433-87 fixing the MAC of chemical materials in the soil.

B: band noise - noise which has continuous spectrum and width of this spectrum is more than one octave

T: tonic noise - noise which has spectrum with separate striking noise

Annexe 2

# Presentation of the Environmental Situation in Uzbekistan

(Source: PADECO - JTC, May 1997)



#### Annex 2

Presentation of the Environmental Situation in Uzbekistan (Source: PADECO - JTC, May 1997)

## Physical Resources

## (a) General Topography and Climatic Conditions

- 12. The Republic of Uzbekistan is located in the central part of Central Asia having two major rivers, the Syrdaria and Amudaria. The northernmost point is in the north-east of the Ustiurt Plateau (45° 35' north latitude), while the southernmost point is near the town of Termez (37° 11' north latitude); the western end is on the Ustiurt Plateau (56° east longitude), while the eastern point is located in the southeast part of the Ferghana Valley (73° 10' east longitude). The total area of Uzbekistan is about 447,400 km²; of which 78.8 percent consists of plains and 21.3 percent of mountains. Elevations in mountainous areas reach as high as 2,000 m above sea level, while the lowest areas are situated in the lower reaches of the Amudaria river and along the Aral Sea coast (60-100 m above sea level).
- 13. Geographically, Uzbekistan is located in the subtropical zone, though its natural conditions differ considerably from subtropical countries, due to its remoteness from warm oceans, and the dry and cold arctic air masses that can often come from the north. High mountains prevent wet and warm monsoons from coming from the south. There are many sunny days in Uzbekistan, and daily and annual temperature differences are significant. In the plains areas of Uzbekistan, such as the Kyzylkum desert, the Mirzachul Steppe, and the Karshi Steppe, average sunshine is about 4,460 hours/year.

14. Average annual temperature on the plains is 25-30°C, and in the mountains 20-25°C. In summer, warm Turan tropical air masses are formed over the plains. The air becomes dry and hot and filled with fine dust. From May until October it is constantly hot. Average July temperature on the plains and near the mountains is 26-32°C. Maimum temperatures often exceed 40°C. On the other hand, January temperatures often fall below zero; for example, the average minimum temperature is -1° in Tashkent and -10° in Ustiurt. Average annual rainfall fluctuates from 100 mm in the West to 700-800 mm in the mountain areas. Average humidity in dry summer months is 20-30 percent, while in the wet winter months it is 65-80 percent.

#### (b) Soil Types

15. The variety of climatic conditions in Uzbekistan result in the following representative soil types: alluvial, sandy, meadow-gray, and salt-marsh.

## (c) Water Resources

#### Surface Water

16. The territory of Uzbekistan is situated in the Aral Sea basin. Water resources of this basin are generally classified into the two sub-basins (i.e., Syrdaria and Amudaria). A total of 32 water reservoirs have been built in Uzbekistan with a total capacity of 40 km³.

#### Syrdaria River Basin

17. The area of the Syrdaria river basin is about 443,000 km² (32 percent of the whole territory of Central Asia). The potential surface water volume of the Syrdaria basin is estimated at 37.2 km³, fluctuating from 22.5 km³ in shallow-water years to 45.4 km³ in full-flowing years). About 3.1 million hectares are irrigated in the Syrdaria river basin, of a total arable land of 10-11 million hectares. The rate of the basin's river watershed utilization can be as high as 92 percent.

#### Amudaria River Basin

18. The potential surface water volume of the Amudaria river basin is estimated as 65.9 m³, with a possible volume of 57.5 km³ for economic utilization. An estimated 7 million hectares in the Amudaria river basin is suitable for irrigation, of which approximately 3.5 million hectares is irrigated.

## **Underground Water**

- 19. Uzbekistan possesses huge reserves of underground water. The estimated volume of the potential capacity of underground water is as large as 450-500 m³ per second. Underground water deposits are mainly located in the mountain areas of the Republic. These deposits are found in the forms of ground (undersoil) and artesian (interlayer) waters.
- 20. Uzbekistan has several artesian basins, with the largest ones located in the Ferghana, Zarafshan, Kashkadaria, and Surkhandaria hollows, in which mineral waters of 40-70°C can be

found in the layers as deep as 1.500-3.000~m. Annual consumption of underground water is estimated at about  $1.5~\text{km}^3$ .

## (d) Geology/Seismology

- 21. Uzbekistan has had a lengthy earth crust transformation that has resulted in unique tectonic structures in the Tyan-Shan Earthquake-Prone Area and the Turan Plate. The Tyan-Shan Earthquake-Prone Area incorporates various size of tectonic structures found in the Chatkal, Kuramin, Turkestan, and Zerafshan ranges. The Turan Plate also consists of diverse positive (elevated) and negative (hollows) structures.
- Massive volcanic activities occurred during the Alpine period of mountain formations along with tectonic movements. These activities have led to ore-bearing, non-ferrous, rare and valuable minerals. However, the earth crust in Uzbekistan's territory still features tectonic movements, which often cause earthquakes. Tremors may exceed 8 on the Richter scale. Historical documents testify that powerful, destructive earthquakes occurred in 1240 in the central part of Khorezm Province in Urgench; in 1972 in Urgut; in 1818 and 1821 in Bukhara; and in 1868 in Samarkand. Early this century there were several major earthquakes in Uzbekistan: in 1902 in Andijan, in 1903 in Urgut, in 1932 in Tamdybulak, in 1935 in Boisun, in 1946 in Chatcal, in 1954 in Brichmulla, a very destructive one in Tashkent in 1966, and an even more powerful earthquake in Gazli in 1976.

## **Ecological Resources**

# (a) Terrestrial Ecology, Wildlife, and Rare/Endangered Species

- 23. The flora and fauna of Uzbekistan feature great diversification. There are more than 3,000 plant species; of which about 9 percent are endemic to the country. About 90 mammal species, around 60 reptile species, 400 bird species, and more than 40 kinds of fish species have been found in the country.
- 24. Uzbekistan's unique "oasis zones" are located in the valleys, flood areas, and river mouths of the Syrdaria, Amudaria, Zarafshan, Chirchik, and Akhangaran rivers. Unique natural areas feature *tugai* landscape, a peculiar form with a moist-loving grass (e.g., sharpedge reed), bush (e.g., reed-like *arundo*), and trees (e.g., *tal*, *turanga*, and *jida*).
- 25. Jackals, foxes, wolves, and reed cats can be found in *tugai*. Uzbek boars and *khangul* deer, often called the "pearl of Uzbek fauna," inhabit in thicker *tugai* areas. A variety of birds (e.g., herons, pelicans, geese, ducks) are also found in *tugai* landscapes. Some reptiles can be found in the deserted areas; major species include lizards (agamas, hekkons), snakes (cobras, rattlesnakes), and spiders (black widows and scorpions).
- 26. Rare and extinct species include Mrnzibar ground hog, Tyan-Shan brown bear, Indian honey eater, Central Asian otter, lynx, leopard, snow leopard, Bukhara deer, *jeiran* (steppe goat), screw-horn goat, Ustiurt ram, and Tyan-Shan ram. Representative bird species in this category include pink pelican, "curly" pelican, Turkestan white stork, black stork, swan, steppe eagle, "snake-catcher", and falcon. Hentuan lizard, gray lizard, Ferghana sand lizard, and Central Asian cobra are considered rare reptile species inhabiting the Republic.

## (b) Aquatic Ecology and Fish Resources

27. Fish resources found in water bodies in the Republic include sturgeon, which lives only in the Amudaria River and is registered in the official "Red List" of rare species. Various species of the trout and pike families are also found in the Amudaria and Syrdaria rivers. Other freshwater fish including carp, catfish, snake fish, perch, and *soodak* (a kind of pike) are widely found in lakes, canals, and water reservoirs. Rare fish species include Aral "thorn," Amudaria "fake spade-shape nose," and Aral Sea "mustache" fish.

Human Use Values

#### (a) Population

28. In 1995 an estimated 22 million people lived in Uzbekistan, and the average population growth rate is 3 percent. Uzbeks made up about 70 percent of the population, with other groups including Russians (8 percent), Tajiks (5 percent), Kazaks (4 percent), Tatars (3 percent), Karakapaks (2 percent), Kyrgyz (1 percent), and Koreans (1 percent). The dominant religion is Islam (predominantly Hanafi Sunni), adhered to by about 90 percent of the population, with most of the remaining 10 percent Christian. The average population density in the country is approximately 40 persons per km². The most densely inhabited regions include the Ferghana Valley and Tashkent Province, with the highest densities about 100 persons per km², followed by Samarkand, Navoi, and Surkhandaria Provinces. Population density is very low in Karshi, Khorazm, and Karakalpakstan Provinces, between 0 and 1 person per km². Urban inhabitants account for about 40 per cent of total population, with the remaining 60 per cent residing in rural areas. Children younger than 14 years old constitute more than 40 per cent of the population

#### (b) Industry

29. There are several types of industries established in Uzbekistan; of which cotton-related industry has the largest share with 19.2 percent of total industrial output. This industrial subsector has more than 100 cotton gins and 455 procurement stations. In addition to cotton yarn production, these enterprises produce lint and prepare the seeds to be planted. Other representative industries include the following subsectors:

<u>Power Supply</u> (3.3 per cent): There are hydropower plants and thermal plants fired by natural gas and coal.

<u>Fuel</u> (4.1 percent): This subsector is composed of oil refining, oil processing, coal mining, and gas production.

<u>Iron and Steel</u> (4.6 per cent): Non-ferrous metallurgical industry is one of the most advanced subsectors in Uzbekistan and is represented by its copper and zinc-lead branches, as well as by the production of other rare and precious metals.

¹ The Red List of threatened animals worldwide is compiled by the World Conservation Monitoring Centre of the International Union for the Conservation of Nature and Natural Resources.

<u>Chemicals</u> (7.2 per cent): This is another of the most advanced industrial subsectors in the Republic, with major activities including the production of mineral fertilizers and chemical yarn.

Machine-building (16.5 per cent): The major activities of this subsector include the production of machines for agricultural activities and the textile industry. In 1996, a car factory was opened. Also there is an aircraft industry, which produces civilian aircraft.

<u>Construction Materials</u> (5.6 per cent): The major products of this subsector include various types of construction materials (e.g., cement, prefabricated ferro-concrete, ceramic, heat-insulating, and non-ore-bearing construction materials). One of the fastest-growing industries in this category is the manufacture of clad (facing) materials made of natural stone (marble and granite).

<u>Textiles</u> (17.2 per cent): This subsector consists of silk weaving, sheep breeding, fabric knitting, and carpet making.

<u>Food Processing</u> (18.1 per cent): This agro-based subsector produces oil and fat, cannery, confectionery, bakery and dairy, meat, wine, tea, and flour products.

#### (c) Agriculture

- 30. The agricultural sector plays an important role in the economy of Uzbekistan. More than 30 percent of the population is engaged in agricultural activities, with cotton growing accounting for the largest number of farmers. Other major agricultural products include grain, fruit, and vegetables, as well as livestock and poultry breeding (currently under development).
- 31. Uzbekistan is the world's eighth largest gold producer, extracting some 65 million tons annually, most of it from the Murantau Mine in the Kyzulkum Desert, which is considered the world's largest open-cast mine. Other mineral resources include coal, uranium, and other non-ferrous and rare metals.

#### (d) Transportation

32. Uzbekistan has developed road, rail, and air transportation systems. Railway transport in Uzbekistan was initiated in 1888. The railway network connects all provinces of the Republic and neighboring countries. Road transport has been developing mainly in recent years; the length of commonly used roads now exceeds 52,000 km. A considerable share of goods and passengers are carried by road. There are airline connections among major cities and some regional centers. Many international airlines go through Uzbekistan from Europe to Asia and to the Pacific Rim.

#### (e) Land Use

33. Agricultural enterprises utilize 32.888 million hectares including 26.237 million hectares of farmland. Most arable land is used for cotton and grain crop production. In spite of the availability of huge tracts of arable land, the country's limited water resources constrains the expansion of farming activity.

## (f) Power Supply

- 34. A number of small hydropower plants were built on trunk water channels in Bozsu, Dargam (Samarkand Province), Shakhrikhansai (Andijan Province), and North Ferghana (Namangan Province). In 1948, Farkhad power plant on the Syrdaria River (20,000 kWt) was put into operation, followed by the Charvak power plant on the Chirchik River (620,000 kWt), and the gas-fired Khojidavlet power plant (150,000kWt with 3 power units).
- 35. Thermal stations were built after 1960. They use natural gas as fuel. These include Angren power plant (600,000 kWt-8 power units), Navoi (839,000 kWt-9 power units). Syrdaria (4,400,000 kWt-10 power units). Tashkent (1,920,000 kWt-12 power units, and Angren-2 (2,4000,000 kWt).
- 36. A total length of 15,000 km of 35-100 kV and 1,300 km of 220-500 kV power transmission lines has been built in the Republic. All power plants are incorporated into the power supply system of Uzbekistan, which is also interconnected with the power generating systems of Tajikistan, the Kyrgyz Republic, Turkmenistan, and Kazakstan.
- 37. Generated power is used for the following sectors with the respective shares as shown:
- Industry (60 per cent);
- Agriculture (25 per cent);
- Public utilities (12 per cent); and
- Transport (4 per cent).

#### **Ouality of Life Values**

### (1) Socioeconomics

- 38. Uzbekistan's basically agrarian economy is dominated by two realities: (i) massive artificial irrigation and fertilization of arid and semi-arid areas needed to sustain production of major crops such as raw cotton and the resulting severe ecological and economic strains, and (ii) the crumbling of the old Soviet trade system, leaving the Republic a producer of far more raw materials than finished goods, in spite of development of industrialization around Tashkent, Samarkand, Bakhara, and the Ferghana Valley.
- 39. Uzbekistan has been facing the daunting job of curing its addiction to the cotton market and returning its rich soil to food production. The Republic alone provides about two-thirds of all the cotton grown in the former Soviet republics. Annual output of 1.5 million tons makes it the world's second or third largest cotton producer. Other major agricultural subsectors include fruit and rice, especially in the Ferghana Valley.
- 40. The Republic is still a net importer of electricity, machinery, bulk construction materials, food, oil and gas, and with limited hard currency reserves to pay for it. Its main exports include, of course, raw cotton accounting for over 40 per cent of the value of total agricultural output, and cotton thread, cloth and clothing, plus some non-ferrous metals. Most revenue from gold production is believed to be used for the purchase of food and fuel. Over four-fifths of the country's trade is still with CIS countries.

## (2) Archeological/Historical/Cultural Properties

41. The most impressive surviving artistic heritage of Uzbekistan is its historical architecture, best represented by perhaps the world's most audacious and beautiful Islamic religious building found in Bakhara and Samarkand. Religious buildings found in the Republic mainly fall into three categories: mosques, mausolea, and khanakas (all of which are Islamic seminaries/monasteries). Some of most striking examples of all three can be found in Samarkand.

## (3) Recreational Sources and Development

- 42. Major cities of Uzbekistan are well equipped with recreational facilities. For example, Tashkent, the Uzbek capital, has a number of spacious city parks and entertainment facilities (i.e., theaters and concert halls). Cultural entertainment (e.g., folk music, dance, drama, opera, and ballet) can be seen in the facilities.
- 43. With its rich landscape, the Republic is well-endowed with outdoor recreational resources. Some examples include Chimgan recreational zone located on the south shore of the Charvak Reservoir, an outrider of the Tian Shan Range. This large recreational zone is about 80 km from Tashkent and attracts visitors year round. This recreational zone consists of the Charvak Watershed Nature Reserve in Ugam-Chtkal National Park, and features mountain hiking, water boating (e.g., rafting and kayaking), and skiing. Although entertainment facilities are relatively equipped, no significant improvement of these facilities, particularly accommodation, has recently been undertaken.

## 2. Environment Specific to the Three Route Portions

## (a) Chaengeldy-Tashkent-Mehnat Portion

- 44. Physical Resources: The terrain of this portion lies in the "Tashkent Oasis," which covers the vast expanse of flat plains tilted upward towards the western Tian Shan ranges. The rail line in this portion traverses relatively flat terrain.
- 45. Ecological Resources: The terrestrial biome type of this semiarid area is characterized by shrublands with an annual rainfall of between 260 and 800 mm; the northeastern part of this portion has more rainfall than in the southwest. Natural flora are represented by couch grass and bulbous barley in the northeastern part of the region, with ephemera (short-lived) species (e.g., flomis. psoralea, and cusinia) common in the lower part.
- 46. Human Use Values: Due to the relatively abundant precipitation, the land in this area seems to be more appropriate for farming than in other portions. In fact, farming is observed in sections along the rail line. The major land use types in the region are cotton and wheat fields. Some barley fields, paddy fields, and vegetable and fruit cultivation may also be observed, and animal husbandry is important in this region. The most active industrial zone in the Republic is located in this portion.
- 47. Quality of Life Values: There are no important aesthetic, archeological, or historical resources in the Project area of influence. It has been found that some residential areas near

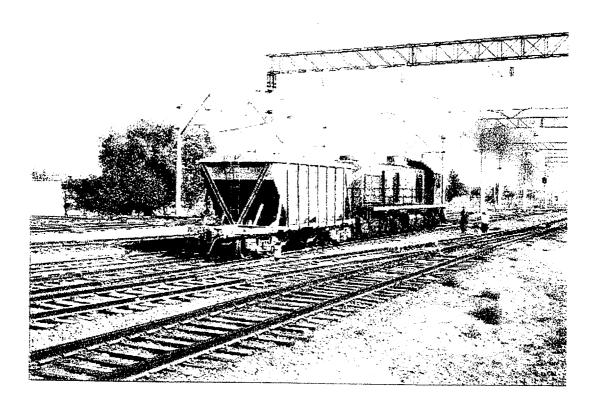


Annexe 3

**Photo Presentation** 



# TASHKENT MARSHALLING YARD



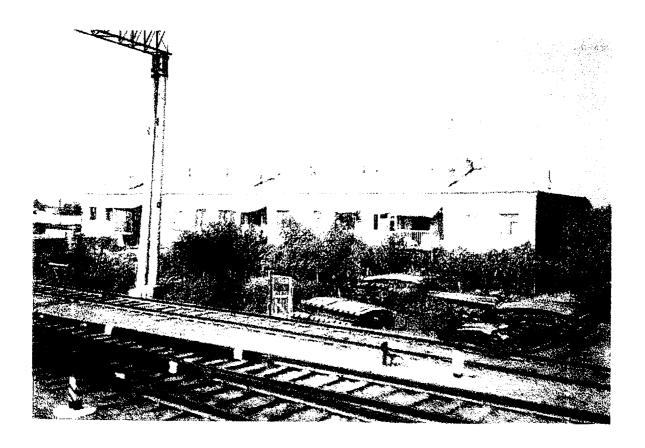
 ${\sf MARSHALLING\ LOCOMOTIVE}\\ \hbox{(\ Note the\ high\ emission\ of\ smoke\ and\ the\ presence\ of\ two\ persons\ crossing\ the\ tracks\ )}$ 



TANK WAGON soiled by petroleum products



# DJIZZAK-MEHNAT RAILWAY SECTION



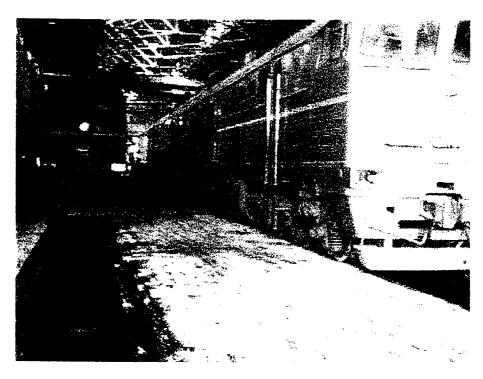
DWELLING HOUSES located 50 m away from the railway line



UNGUARDED CATTLE crossing the line



## TASHKENT LOCOMOTIVE MAINTENANCE DEPOT



 ${\bf MAIN\ ENGINE\ SHED} \\ (\ {\bf ground\ covered\ with\ sawdust\ for\ collecting\ oil\ and\ grease\ leaks\ and\ spills\ )}$ 



LOCOMOTIVE WASHING STATION soaked with petroleum products



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#### 15.1 Introduction

The present chapter reviews train operating principles prevalent on the Railways of Uzbekistan (UTY). Of all the Central Asian Republics, the managers of UTY are in all likelihood the ones for whom the collapse of the former Soviet Union has had the most profound consequences. Like the other republics UTY has been beset by a dramatic drop in traffic and the related decrease in revenues which in turn has impacted the quality of assets maintenance and renewal. However, the managers of UTY also lost in the process their leading role as the managers of the so-called Central Asian Network which, in the days of the former Soviet Union, covered the railways of four of the five Central Asian Republics¹. This means that the scope of their responsibilities has been greatly diminished and that they, more than other managers in other former Soviet networks, have to find a new role that suits their level of competence.

#### 15.2 Network

#### 15.2.1 Routes - Track - Electrification

Currently UTY operates 3,655 route kilometres representing a total trackage of 4,334, i.e. 681 km of double track against 2,973 km of single track. Auxiliary main tracks (2,171 km) and sidings (486 km) put the total of UTY's track assets to slightly under 7000 km.

Various types of rail are used with the most-commonly used being R65 (65kg/m over 65% of the network). Tracks are laid on ballast. Concrete sleepers with a spacing of 54 cm, i.e. 1,840 pieces per km, are used over 82% of the infrastructure.

Track gauge is 1,520 mm and the axle-load is 23 tonne per axle.

The network is electrified over 440 route-kilometre. The electrified sections are:

- from the border station with Kazakhstan to Khavast (around 220 km),
- from Khavast to Djambaï (around 180 km),
- from Khavast to Bekabad (around 40 km).

In general terms, the network can be divided into the four following main parts:

1. the core lines going from the border station with Kazakhstan in the north-east of the country to the border station with Turkmenistan in the west. This line is part of the former main line which, in the days of the former Soviet Union, connected Almaty to Tashkent and Ashgabad and travelled further to the Caspian Sea;

¹ Kirghyzstan, Tajikistan, Turkmenistan and Uzbekistan.

- 2. the line straddling the border between Turkmenistan and Uzbekistan and linking Chardjov (Turkmenistan) to Kungrad (Uzbekistan) and travelling on to either Mangishlak or Aktyubinsk in Kazakhstan. However, operation of this line has known some problems due to its position on the border bewteen the two countries. Thus, the 322 kilometres from Chardjev to Gasodjak and the 72 kilometres from a point 6 km north of Shabat to Takhiatash are in Turkmenistan while the 112 kilometres from Gasodjak to Shabat are in Uzbekistan. This situation is such that the railways of Uzbekistan are now planning the construction of a 342-km new line, single track and non-electrified, which would link Uchkuduk with Nukusss and by-pass altogether the territory of Turkmenistan. In parallel, the railways are also planning to reconstruct the existing line between Navoi and Uchkuduk (290 km).
- 3. the core lines serving the eastern part of the country with a 100-km section crossing the territory of Tajikistan (from Bekabad to Kanibadam),
- 4. the core lines serving the southern part of the country, mailnly the cities of Karshi and Kitab. The line travels on to serve Dushambe, the capital city of Tajikistan.

## 15.2.2 Signalling System

Train protection is ensured through the Automatic Block System (ABS) which provides rear-end protection against following train movements. The system works through 3-aspect colour light wayside signals. Block-sections have a usual distance of 2,000 metres.

The ABS is supplemented by cab-signal and automatic train control. Cab-signalling helps drivers identify the aspects given by wayside signals and is a welcome plus in areas where signals are to be found in great numbers (approach to major stations/yards). Meanwhile, the automatic train control stops the train whenever the driver fails to comply with signals.

## 15.2.3 Centralised Traffic Control (CTC)

All train movements are organised and monitored by the CTC dispatchers which set the routes and points accordingly. The CTC is located in Tashkent. This ensures greater coordination of train movements. Greater flexibility is also gained through CTC-to-drivers radio communication as well as through the existence of long passing loops on single track sections.

#### 15.2.4 Telecommunication

For operation purposes the following telecommunication links are made available:

- central dispatcher to local station operator (dispatching),
- station operators along the lines with each other,
- central dispatchers with train drivers.
- shunting staff to locomotive drivers and station operators,



- party lines for permanent way maintenance staff,
- local lines between two railway stations and signal telephones,
- administrative and managing communications for all staff,
- teleprinter with other railway networks,
- data transmission links with main railway stations,
- public address system at large stations,
- loudspeaker system in freight yards.

#### 15.3 Traffic

UTY serves both freight and passenger traffic. Traffic volumes have decreased rapidly after the breakup of the former Soviet Union. The decrease is due to the economic downturn which followed and the emergence of private road operators which seriously dented the railways leading role on the transportation market. Over the period 1990 thru 1996 ton-km decreased by 68% while passenger-km decreased by 50% (table 1).

**Table 1. UTY Traffic Volumes** 

	1990	1995	1996
Freight (mln ton-km)	56.9	20.2	18.0
Passenger (mln pass-km)	3,600	1,803	1,271

Regarding freight, in 1996, the last full year for which figures were made available, petroleum products and construction materials added up to 70% of UTY's ton-km. Grain and fertilizer constituted another 15% (table 2).

Table 2. UTY's 1996 Freight Traffic (million ton-km)

Products		
Stone coal		507
Coke		16
Petroleum products		8,196
Ores		392
Black metals		414
Timber		174
Construction materials		4,015
Fertilizer		1,076
Garin		1,544
Other		2,090
	Total	17,539

Meanwhile, passenger volumes carried by UTY looked as shown in table 3.

Table 3. UTY's Passenger Traffic - 1994 thru 1996.

Traffic Types	1994	1995	1996
Total			
- Passengers (000's)	21,627	15,722	15,828
- Passenger-kms (000,000's)	5,368	2,497	2,029
Long-Distance Domestic Traf.	,	2,137	2,029
- Passengers (000's)	6,827	2,634	1,579
- Passenger-kms (000,000's)	3,398	1.246	643
Commuter Services	•	-,	043
- Passengers (000's)	10,838	10,348	10.678
- Passenger-kms (000,000's)	785	571	726
International Traffic (1)			720
- Passengers (000's)	3,026	2,228	3,082
- Passenger-kms (000,000's)	967	424	493
International Traffic (transit)			473
- Passengers (000's)	936	512	498
- Passenger-kms (000,000's)	216	156	167

## (1) Both originating and terminating in Uzbekistan.

The above table shows a sharp drop in overall volumes. The drop in freight traffic is mostly attributable to the reshuffle of the national economies in the former Soviet Republics while the drop in passenger traffic expressed in both number of passengers and number of passenger-kilometres, i.e. 27% and 62% respectively over the period, can be attributed to:

- the increase in fares by around 2.5 times from their 1994 level,
- the emergence of stronger competition by road transport operators,
- the development of car-ownership.

## 15.4 Rolling Stock

## 15.4.1 Locomotives

UTY utilizes both electric and diesel locomotives for main-line haulage of trains. Fleet size reportedly stand at 1,000 locomotives for main-line operations, i.e. 60 electric units and 940 diesel units. However, due to the decrease in traffic, in March 1997 only 102 were regularly hauling freight trains (out of which 22 electric locomotives) and 65 were regularly hauling passenger trains (out of which 20 electric locomotives). In other words, only 17% of the total fleet in the books are actually in use. Indeed, there is a large yard outside Tashkent where locomotives in excess of current traffic volumes are parked. These are checked twice a year.

## 15.4.2 Freight Wagons

After the break-up of the Soviet Union the fleet of freight wagons was split among the railways of the various republics. However, a concern common among all the railways was that they would not be getting what they assessed as their needs and the tendency was then to consider as their respective fleet the wagons present on their territory at the time of the break-up. The result is that the existing fleets may always be made up of the wagons best suited to carry the particular types of cargo most commonly carried on a given railway. As of today, UTY's fleet of freight wagons looks as shown in table 4.

Table 4. UTY's Fleet of Freight Wagons.

Year	Box	Flat	Gondola	Tank	Refrigerator	Others	Total
1960-65	1,915	1,324	693	1,513	158	1,287	6,890
1970	578	347	429	303	5	151	1,813
1972	502	246	502	668	6	115	2,039
1974	788	270	400	290	-	152	1,900
1976	878	251	440	252	5	195	2,021
1978	824	285	591	790	54	265	2,809
1980	720	223	558	259	219	300	2,279
1982	552	198	599	207	596	510	2,662
1984	439	244	568	244	392	653	2,540
1985	238	108	340	161	165	303	1,315
1986	234	131	334	135	101	275	1,210
1987	288	165	388	143	456	306	1,746
1988	185	158	372	93	8	278	1,094
1989	150	130	352	120	79	291	1,122
1990	111	82	302	202	43	270	1,010
1991	109	62	217	34	53	114	589
1992	107	6	8	10	1	26	158
1993	69	2	95	10	5	22	203
1994	17	7	11	17	1	14	67
1995	12	2	8	8	1	3	34
Total	8,716	4,241	7,207	5,459	2,348	5,530	33,50

Table 4 shows that above 20% of the fleet is more than 30 years of age while another 32% is of between 20 and 30 years of age. Only 33% of the fleet is 15 years of age or less. This means that in the years to come UTY will have to implement gradual phase-out of an important part of the existing fleet.

## 15.4.3 Passenger coaches

UTY operates 1,449 coaches of a life-expectancy of 28 years. The fleet breaks down as shown in table 5:

Table 5. UTY's Fleet of Passenger Coaches

Type of Coach	Number in Fleet	Country of Origin
« Luxus » sleeper coaches		, sa da gan
(9 compartments with 2 berths each)	42	Former East Germany
Sleeper coaches		Tornier East Germany
(9 compartments with 4 berths each)	552	Former East Germany
Sedan coaches (54 seats each)	742	Russian Federation

In addition to the above, there are a number of other rolling-stock such as luggage vans (65) or restaurant cars (48).

The age of the fleet for the sleeper and sedan coaches is reported as follows:

More than 30 years:	0.6%
26 to 30 years of service:	9%
21 to 25 years of service:	19%
16 to 20 years of service:	29%
11 to 15 years of service:	22%
10 years of service or less:	20%

UTY last acquired new coaches in 1993. Acquisition of another two batches of 38 and 30 coaches is programmed for 1998 and 1999 but neither conditions of payment, nor the country(ies) of origin could be specified. UTY does not produce its own coaches, nor does it have any intention to do so in the near future. The emphasis is laid on proper maintenance and refurbishment to extend the life-expectancy of currently-owned coaches.

UTY plans to write off 323 coaches by year 2000 with 65% of this number earmarked to be scrapped in 1997. If only to maintain the fleet at its current level in terms of units, UTY would have to invest about US\$ 243 million over the same period. This figure, however, is calculated on a one-for-one replacement from a purely mechanical perspective. No market study seems to have been carried out to properly evaluate how long-distance passenger traffic will shape up in the future in the face of increased competition by road and air and how it will impact on rolling-stock requirements.

Maintenance of the existing rolling-stock lags behind schedule due to the problem of supplies of spares. 80% of spares are bought from Germany and Russia while the remaining 20% are produced locally in Tashkent and Andijan. The result is that only 20% of the needed spares are actually purchased. It is estimated that the average maintenance cost per coach per year stands at around US\$ 40,000 (inclusive of labour costs).

In line with the policy of refurbishing coaches, UTY is currently building on Japanese funds a new coach maintenance and repair workshop due to be completed by year 2003.

## 15.5 Problems Affecting UTY's Operations

Like in any railway the level of performances delivered by UTY's operating units is a reflection of the problems faced by the supportive units, i.e. infrastructure, rolling-stock, signalling and telecommunication, in the maintenance and renewal of assets.

Efficient operation is hampered by a mixture of factors which can broadly be placed under three categories:

- track problems,
- signal failures,
- rolling-stock-related problems.

Regarding track, a backlog of maintenance work has led to the imposition of speed restrictions. Currently, around 1,500 km, i.e. 35% of the network, are subject to speed restrictions. However, the restrictions are too readily applied as soon as maintenance work is late in accordance with relevant procedure. This practice which is welcome so far as safety is concerned should, nevertheless, be reconsidered on account that the speed restrictions imposed may not reflect the actual status of the infrastructure.

So far as signalling and telecommunication are concerned, in 1996 the number of incidents was estimated at 2,100 causing delays of an average 3 hours. The main reasons are (i) the lack of available spares (e.g. battery, switch motors, safety relays), (ii) the lack of maintenance logistical equipment hampering the mobility and efficiency of staff (e.g. vehicles and tools in unsufficient number), (iii) the related low productivity of staff.

Finally, regarding rolling-stock the age of freight wagons has created another conservative attitude resulting in technical inspections being carried out each time a train has to be stabled even when the reason is not linked to rolling stock, i.e. change of crew or of locomotive.

All these factors prevent trains from reaching their already low operational speeds of 100 km/h for passenger trains and 80 km/h for freight trains. Transit times are also lengthened through the number of technical inspections all the more so that in marshalling yards, trains are only dispatched after a quota of around 55 wagons has been reached.

This situation should be addressed as quickly as possible as it has a demoralizing effect on staff who in addition may start losing their technical skills. Staff have proved to be alert and motivated. Locomotives and crews are frequently changed and trains dispatched again within only 15 minutes, a very good performance by any standard.

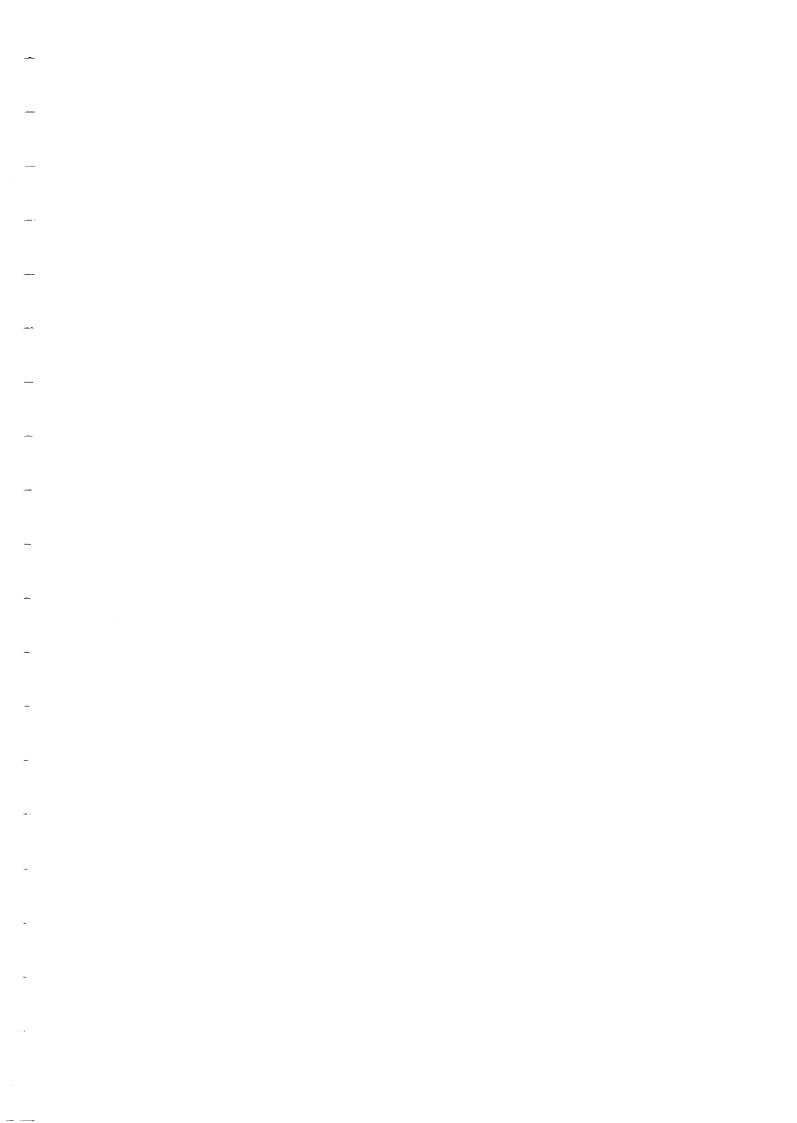
#### 15.6 Action Plan

As much as the Operating Department is dependent on the quality of the assets put at its disposal to deliver a level of service which is both acceptable to customers and able to give the railways a commercial edge over competing modes, there is little concrete action that the managers can do.

However, it is suggested that they should spearhead any reform package as well as define with Marketing where the priorities should be in terms of rehabilitation of track, signalling and rolling-stock and draft a time-scaled action plan with the relevant departments.

#### All actions should lead to:

- increasing the operational speeds of both passenger and freight trains.
- reducing the number of en-route marshalling for wagons,
- doing away with the system of quota before dispatching a freight train to stick more closely to customers' needs and charge services so as to cover operating costs and overheads and generate a profit margin,
- identify the stations where the drop in traffic will, in all likelihood, not be reversed and where
  installations are redundant so as to concentrate resources on line sections where traffic density is
  high,
- develop block-trains which are low on asset-utilisation and generate high revenues,
- open the network to other operators and introduce train path management.



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