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Tacis

# Traceca: Central Asian Railways Restructuring Project
# Module C: Turkmenistan Railway Restructuring Study
# Draft Final Report
January 1998

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## Table of Contents

## Turkmenistan Railway Restructuring Study

## LIST OF APPENDICES

TURKMENISTAN RAILWAYS RESTRUCTURING STUDY

# Executive Summary

## 1. Introduction

The project for the restructuring of Turkmenistan Railways (TDY) forms module C of the TACIS /TRACECA Restructuring Study of the Central Asian Railways. The project is being financed and managed by TACIS / TRACECA in collaboration with the European Bank for Reconstruction and Development.

The Inception Report on the project was presented at the end of September 1997. This Draft Final Report presents proposals for a new operating concept for the TDY designed to improve its performance and efficiency over a long period. It will be neccessary to adjust the system to bring it into line with the demand and to concentrate on the types and volumes of traffic which the railway can handle most economically. Substantial investment will be required to upgrade the system and its infrastructure.

## 2. State / Railway Relationships

Turkmenistan Railways need entrepreneurial autonomy in order to survive and perform well in the arising national and international transport market. This can only be achieved if the relationship between the state and TDY is completely reshaped.

It would be premature to push TDY into an isolated privatisation process without having similar development in the other branches of the economy. Turkmenistan seems far from having a market economy. Its backbone economic activities are presently to a very large extent government driven and controlled. This is the reason why out of the two options :

- privatise the railway and then make it efficient, or
- make the railway efficient and privatise it perhaps at a far later stage,

the Consultants recommend the second solution and propose the corporatisation of TDY within the framework described in this report.

The policy issues are identified, the problems of a state managed enterprise, and the incompatibility of the state's and the railway interests are discussed. The principles for a new framework in the relationship between the state and the railway are established and the role of the state in relation to the infrastructure, and the problems of overstaffing are defined.
There will be a Performance Agreement agreed between the government and TDY.

## 3. Management Reorganisation

The present organisational structure is based on separate functions. A functional-type organisation structure has certain disadvantages. Many businesses overcome the disadvantages of the functional approach by re-organising on the basis of product or service. This involves the setting up of **Separate Business Units** (SBU's) within the organisation.

Our proposed structure is based on the principle of Separate Business Units for passenger and freight services, which are the main commercial activities of Turkmenistan Railways. It provides

for separate operation and accounting for the infrastructure, which is desirable at present and will facilitate third party operator access in the future.

**We propose two main Strategic Business Units, one for Passenger Services and the other for Freight Services.** Each unit will be responsible for its own marketing and sales, the operation of its services, management of its own staff and its own management accounting.

**We propose two Service Units, one for Infrastructure and one for Rolling Stock.** Each will have its own operations, technical, management accounting and staff functions. These Service Units will provide services to the Passenger and Freight Business Units, and charge for them.

**The Director General will be responsible for overall direction of Turkmenistan Railways.** He will act in accordance with the corporate mission, strategy, policy and budget as agreed with the Cabinet of Ministers. He will co-ordinate the activities of Business and Service Units, monitor their performance and take corrective action where necessary.

**The Director General will be assisted by a small headquarters staff, grouped into two units, for Corporate and Administration Services.** There are still a number of key services that should be retained at headquarters because the services can be provided most economically and effectively centrally, or because they are essential to enable TDY to operate as a single corporation.

The proposed grouping of the services in the Corporate Unit are Corporate Planning, Finance & Accounting, Information Technology, Economics, Central Purchasing and Property Development. For the Administration Unit we propose Legal, Human Resources, Services to the Executive Board, International Relations, Safety and Internal Audit.

**We propose that each of the Business, Service and Headquarters Units be led by a Director.** These six Directors, under the chairmanship of the Director General, will constitute the Executive Board. The Executive Board should meet regularly in order to co-ordinate the activities of TDY.

## 4. Legal Framework Of TDY

A review of the draft law on railway transport submitted to Parliament in September 1997 suggests that the basic structure will be a railway infrastructure owned by the state, with TDY as an organ of the state for the discharge of the state management function. Third party access is not ruled out; however the law does not anticipate third party operators providing their own services on the TDY railway infrastructure, nor does it give protection against abuse by TDY of its monopoly position.

A number of recommendations are made :

- a structure for state supervision of railways
- a management structure for TDY which will enable it operate commercially and facilitate corporatisation
- transparency of accounting
- access to railway infrastructure by other railway transport providers (including the state railway systems in neighbouring countries )
- a system of licensing the competence of railway operators and their rolling stock coupled with an entitlement to access to the railway infrastructure on non-discriminatory terms
- the inclusion of safety within the competence of the state supervision ( as opposed to supervision by TDY )

Improvement, New lines, VFM,

- formalising the relationship between the state and TDY on the basis of a performance agreement
- the reimbursement of public service obligations on a contractual basis
- a framework approach providing for flexibility and facilitating future developments

The consultants recognise that the recommendations will take time to implement and that transitional arrangements will need to be provided for in the railway law.

## 5 Traffic Analysis

Two scenarios for traffic forecasts have been considered : optimistic and conservative :

- The conservative scenario shows that tonnage volumes are growing slightly up to the year 2002 and then remain steady. Average distance is reducing and therefore the impact on volumes in tons kilometres and revenues are stable and start to reduce after the year 2002. Revenues in 2007 would be reduced by 10% in constant manats. Passenger traffic would follow its present trend.

- The optimistic scenario shows high increase in terms of tonnage carried and slow but steady increase in volumes in tons kilometres and revenues. Revenue increase would be around 25%. Passenger traffic would maintain its position.

Passengers traffic forecasts are frankly pessimistic due to their competitive position. We assume that long distance traffic will disappear in the very short term.

competitive issues

## 6. Financial Review of TDY

The consultants were provided with summary information by TDY which enabled an assessment to be made of the current profitability and financial position of TDY. These summary statements covered the financial year 1996 and the first six months of 1997.

The detailed financial analysis is contained in section 6 of this document and the comments that follow serve to highlight important issue that affect the financial position of TDY:

- TDY has been required to undertake the construction of new railway lines out of its own scarce resources. It did not have access to any commercial borrowing facilities and it was not provided with any state funding. The construction of the new lines has been an enormous drain on the resources of TDY and it has left it with very low cash reserves and a very high current liabilities balance. Current assets are half the value of current liabilities in the balance sheet as of 30.06.1997.
- Since January of 1997 a hard currency fund for transport development has been in operation. TDY is required to give its foreign currency to the hard currency fund and it will be entitled to draw on the fund in manats at the official exchange rate of 4,000 manats to the dollar. It may obtain foreign currency from the fund after providing written justification. At the end of September TDY had 16 million US$ lodged with the fund. The requirement to hand over its foreign currency to this fund is further worsening the cash position of TDY.
- The consultants were also informed that TDY receives approximately 40% of its revenue in the form of barter goods. This is a further drain on TDY's resources and dilutes the value of the revenue as barter goods are often acquired at significantly higher prices.
- In order to generate sufficient cash to meet it basic needs, e.g. payment of salaries and wages, TDY has resorted to increasing its tariffs where possible. Passenger tariffs have increased significantly in the last year to the extent that passenger volumes have now declined to less than half the 1996 level.

- TDY is overstaffed when account is taken of the decline in the volume of traffic in recent years.
- TDY is not accounted for as a single commercial entity but as a group of 53 units that are separately assessed for tax purposes. In 1996 TDY made a foreign currency loss of 101,000 million manats or approximately $20 million dollars on the payment of a debt to Russia. Despite making this enormous loss TDY was required to pay taxes of 9,390 million manats because each of the units that make up TDY, right down to locomotive depot level, is independently assessed for tax.

TDY is a potentially profitable railway that is in financial difficulties because it does not have independent control over its activities. It does not have control over commercial revenues, it does not have immediate access to its own foreign currency earnings, and it does not have full control over its bank accounts. In addition TDY is forced to undertake major capital expenditure programs which it cannot afford

If TDY is to operate as a commercial organisation it must be given control over its finances and be permitted to make expenditure decisions based on commercial criteria.

# 7 Railway Operations

TDY is operating a safe railway, designed to transport large quantities of freight and high numbers of passengers. In a changed environment, after the independence of the Republic of Turkmenistan, TDY has more or less continued previous operations on a low key level.

The following are the main recommendations relating to railway operations :

- the number of train crossing facilities should be reduced,
- the number of marshalling yards should be reduced and in other cases the yard dimensions and facilities should be adjusted to actual needs,
- ancillary facilities for freight as well as passenger traffic should only be maintained if commercially justified.
- unnecessary wagon and coach examinations should be skipped. Station and marshalling yard personnel should be reduced to actual needs.
- utilisation of locomotives should be improved by increasing the length of locomotive runs.
- locomotives and locomotive personnel should be individually rostered. The deployment of shunting locomotives should be revised by means of number of locomotives and duration of deployment.
- container facilities should be developed to handle modern 20 and 40 foot containers.
- the timetable for passenger trains needs to be adapted to the needs of the customers, and a timetable for the running and operating of freight trains needs to be introduced focusing on longer train runs and reduced stops for wagon inspection and locomotive changes.

# 8. Infrastructure

The TDY track condition, on the whole, is reasonably good and maintenance is carried out in accordance with the norms laid down in the pre-independance era. The manning levels and equipment used in track maintenance and renewals is reviewed. The condition of the track components are reviewed, and the needs to provide improvements to switches and crossings steelwork, glued insulated joints, replacement of concrete sleepers, and ballast quality and grading, are identified.

It is recommended that in order to improve the quality of track condition and introduce cost reductions, it is neccessary to move to mechanised track maintenance, and investment of

Benefit Quantified ?

15.9mln$ is provided for the necessary tamping/lining machines, ballast regulators ballast cleaning machine and hopper ballast wagons.

Priority attention is needed to eliminate speed restrictions arising from condition of switches and crossings, and the poor condition of timber sleeper track, and 16.0mln$ is provided in the investment programme for 500,000 replacement concrete sleepers, together with upgrading the concrete sleeper factory, and producing concrete bearers for switches and crossings. In addition 0.5mln$ is provided for upgrading and welding repairs of switches and crossings, while 1.0mln$ is allocated for improvement of ballast grading in supply quarries.

It is proposed also that substantial reductions in staff levels in track maintenance be achieved, and a new manning level is recommended to back up a mechanised maintenance system, and 2.0mln$ is allocated for purchase of the necessary powered tools to assist the maintenance gangs.

## 9. Signalling and Telecommunications

The present signalling and telecommunications facilities are reasonably satisfactory for the present level of traffic, but maintenance of the system suffers due to shortage of spare parts, and inadequacy of tools, small equipment, and instrumentation.
TDY's proposals for replacement of obsolete equipment is reviewed and prioritised, and the immediate investment requirements are identified as follows :

**Signalling**

- spare parts, tooling and instrumentation must be made available as quickly as possible to ensure proper maintenance for all installations,
- the Turkmenbashi station installations stand in great need of modernisation.

The investment budget comes to USD 2,500,000.

**Telecommunications**

- Replacement of radio equipment:
- Modernisation of telecommunication installations in Bami, Dushak and Mary stations.

The proposed investment is USD 1,500,000

Further investment requirements will be based on the conclusions of Module E issued by the UIC.

## 10 Rolling Stock

A five year investment plan relating to potential investments in locomotives, coaches and wagons, and associated workshops is given in Section 14. A summary of the areas recommended is as follows :

**Locomotives**

A programme of investment in re-engined and new main line locomotives should be started now to prevent a shortage of locomotives just beyond the 5 year investment plan.
Recommendations are:

- re-engine ten 2TE10 locomotives.
- purchase eight new freight locomotives.

Locomotive capital investment in the five year plan is $ 35.5m.

Future fleet size for operational requirements including maintenance should be 90 locomotives.
No investment in shunting locomotives is required within the next ten years.

**Passenger Coaches**
There are sufficient coaches to meet the current needs of TDY.
Upgrading of passenger facilities is required to meet commercial needs.
An investment of $2.0 m is recommended for upgrading coach depots.

**Freight Wagons**
Unless a relaxation of the fixed CIS rules on wagon life can be agreed, there will be a need to commence a programme of wagon replacement. It is recommended that re-negotiation of these rules be pursued by TDY
However the condition of many of the wagons is such that with proper maintenance their life could be extended by 5-10 years. Investment of 4.0 mln $ is recommended in upgrading wagon workshops.

**Locomotive Depots and Workshops**
All major repairs to locomotives, which are undertaken abroad at present, should be carried out in Turkmenistan. Ashgabat works has the skills, and with re-organisation, the room to carry out the work.

An investment in upgrading facilities and new equipment of $ 4m will be required for major repairs of main line and shunting locomotives.

An adequate stock of spare parts is essential, and 3.0 mln$ is recommended for purchase of these.

## 11. Management Information Systems

Modern economy markets tend constantly to change in their demands upon the transport sector and it will be necessary for the TDY management to respond quickly to that change. This requires timely and accurate information, particularly in the financial area, which in turn means that there must be automated information systems in place to enable the provision of accurate and timely data at all levels of management.

It is recommended that TDY begin to design and develop a set of integrated information systems with a financial management system at the core. In so doing, the present freight oriented systems should be kept and data interfaces built between them and the new systems. It is also recommended that the passenger function acquire some Russian system EXPRESS2 terminals to cover ticket issuing, reservations and revenue accounting. The overall recommended plan will also cover payroll, stores control, project/cost accounting, thus providing an ability to produce a comprehensive set of management information.

The plan can be achieved over a period of five years but requires careful and strict managing with a total commitment from all levels of management. As mentioned earlier, the current lack of appropriate numbers of skilled staff will mean a considerable influx of external expert help, but this will be with a view to a 'training the TDY trainers' approach ensuring that external manpower costs are minimised at an early stage in the project time scale.

The financial package implementable within two years will cost about $6 million and the total over five years a further $3.5 million.

## 12. Human Resources

The review of Human Resources is undertaken in the context of the particular need to inculcate modern market oriented values and practices into the behaviour and performance of TDY's staff at all levels and to ensure that productive use can be made of all human and capital resources.

In the context of employee productivity, proposals are made as to the critical importance of adopting targets to which staff numbers should be reduced to bring productivity in TDY to a level commensurate with future viability. A phased approach to the achievement of these targets is proposed for the main activities of TDY resulting in a reduction in staff numbers over a ten year period from 21,573 in August 1997 to 8,630 in 2007, with the possibility of achieving 80% of this reduction by 2002.

The social dimensions of the proposed restructuring are considered in the context of the personal disruption that can arise for groups of staff and for individual employees at all levels, of the need to maintain the existing embargo on recruitment, the need for employees to change from traditional work practices and adopt new ones, the possible need to relocate employees in new work locations even if in some cases, such moves may require a change of residence. The concept of a Social Safety Net designed to alleviate the principal adverse social consequences of making changes which are essential to survival is developed and recommended. In this context the main areas covered were problems relating to loss of employment, losses in earnings, and disruption because of changing work locations. The concept of sharing with employees part of the savings generated by the modernisation and restructuring of TDY, by way of 'productivity' wage payments is outlined, developed, and recommended. The benefits of such an approach to the payment of salary and wages increases in an economy which is subject to high inflation.

The current role of the staff development and training function in TDY is reviewed in the context of the new need to facilitate the change process with enhanced training, communications and teamwork skills which would ensure changes in the performance of the staff of TDY appropriate to a new customer focused organisation.

# 13 Environmental Review

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.
The present environmental review focuses on the components of the restructuring process likely to induce environmental effects: rehabilitation of tracks, changes in operation, maintenance and manufacturing practices.

The main environmental impacts identified are as follows:

- decrease of air pollution assuming that the replacement or re-engining of part of the locomotive fleet will reduce the pollution rate,
- reduction of noise levels alongside the rehabilitated sections, despite the expected slight traffic growth,
- waste production during the works period (ballast, sleepers, .etc.),
- impacts linked to the procurement of new materials and associated operations (development of quarries, sleepers processing, transport and storage, removal and replacement of the track materials).

In Turkmenistan, the transport of dangerous goods mainly involves petroleum products. Most of the dangerous goods are transported in tank wagons, which have a high age profile.This specific issue is ruled by FSU regulations, which are less stringent than the international RID convention. Owing to some of the project components, transport of dangerous goods should gain in safety.
It is recommended that TDY's Department of Labour Safety and Environmental Protection (DLSEP) be strengthened, in particular by the taking-on of an environmental specialist and the supply of new equipment, for ensuring the follow up of the previous measures, as well as for carrying out their current duties.

# 14. Investment Analysis

The aim of the overall investment programme is to :

- improve the infrastructure maintenance and reduce the related costs
- improve operation and reduce the corresponding cost
- improve the locomotive utilisation and reduce maintenance cost
- provide TDY with the equipment, parts and materials to guarantee an efficient and safe operation.

Therefore the investments proposed are geared to two major fields : infrastructure and rolling stock.

Today the operation on TDY 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 TDY with a standard quality of materials in order to upgrade the lines (ballast, crossings, sleepers and bearers) and with the modern equipment to carry the upgrading and maintenance activities.

On rolling stock TDY is experiencing a strong shortage of rolling stock and significant maintenance cost, cannibalising old existing stock. Considerable cost is incurred in having major overhauls of rolling stock outside Turkmenistan, utilising also scarce hard currency. The aim of the investment plan is to provide TDY with the facilities and equipment to be self sufficient in carrying out all repairs and overhauls in house.

The investments were split into 8 packages which were carefully evaluated on the basis of the information provided and the assumptions which had to be made. When information was lacking, simplification was achieved, making sure that these would not affect positively the results.

The investment program details is shown underneath. It does specify the package number, the nature of investment, its cost, the expected IRR and the time schedule for implementation.

| | TYPE OF INVESTMENT | COST | IRR | FIVE YEAR PROGRAMME | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | in % | 1 | 2 | 3 | 4 | 5 |
| | **I. INFRASTRUCTURE** | **38.36** | | **12.15** | **12.48** | **8.13** | **2.80** | **2.80** |
| PACK. 1 | Crossings | 0.40 | [1] | 0.20 | 0.20 | | | |
| | Assistance and training on resurfacing by welding | 0.10 | | 0.05 | 0.05 | | | |
| PACK. 2 | Concrete sleepers (to replace timber sleepers) | 14.00 | 15.83 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 |
| PACK. 3 | Improvement of concrete sleepers factory | 1.00 | 15.34 | 1.00 | | | | |
| PACK. 4 | Improvement of ballast quarries | 1.00 | 19.55 | 1.00 | | | | |
| | Tools | 2.00 | | 2.00 | | | | |
| | Tamping machine | 7.00 | | | 3.50 | 3.50 | | |
| | Equipment for 2 sleepers inserters gang | 2.80 | | 1.40 | 1.40 | | | |
| | Ballast cleaner | 3.00 | | 1.00 | 2.00 | | | |
| | Ballast regulators | 1.70 | | | 0.83 | 0.83 | | |
| | Ballast wagons | 1.40 | | 0.70 | 0.70 | | | |
| PACK. 5 | Purchase of equipment for SET | 4.00 | 14.00 | 2.00 | 1.00 | 1.00 | | |
| | | | | | | | | |
| | **II. ROLLING STOCK** | **51.00** | | **8.30** | **16.20** | **11.70** | **8.80** | **6.00** |
| PACK. 6 | Purchase 8 new freight locomotives | 24.00 | 11.47 | - | 6.00 | 6.00 | 6.00 | 6.00 |
| PACK. 7 | Re-engine 10 locomotives 2TE10 | 14.00 | 24.92 | 2.80 | 4.20 | 4.20 | 2.80 | |
| PACK. 8 | Upgrade loco workshops | 4.00 | 29.28 | 2.00 | 2.00 | - | - | - |
| | Upgrade coach workshops | 2.00 | | 1.00 | 1.00 | - | - | - |
| | Upgrade wagon workshops | 4.00 | | 1.00 | 1.50 | 1.50 | - | - |
| | Spares stock | 3.00 | | 1.50 | 1.50 | - | - | - |
| | | | | | | | | |
| | **Technical Assistance to TDY in implementing restructuring** | **4.64** | | **0.64** | **1.00** | **1.00** | **1.00** | **1.00** |
| | | | | | | | | |
| | TOTAL | **94.00** | | **21.09** | **29.68** | **20.83** | **12.60** | **9.80** |

Most of these packages are showing acceptable IRR. The purchase of locomotive is showing an IRR of 11.47%. Re-engining was limited to rolling stock which is not too old and in satisfactory conditions.

## 15. Business Plan

The draft business plan has been prepared using a spreadsheet model which has been used successfully in other railway studies. The projected income statements, cashflows and balance sheets are all connected and the impact of operational changes automatically flows through to the cash flow statement and to the balance sheets.

It is essential that TDY prepares its own business plan in the period immediately following the restructuring and the methodology used in the preparation of this draft will prove to be very useful at that time.

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1 Pay out time is 1 year

The business plan concentrates on the cost implications associated with the restructuring proposals. As a result of this the revenue has been projected as remaining constant in real terms during the plan period, and this ensures that the impact of any cost changes in the plan are reflected in the net surplus/deficit position without the benefit of any offset from revenue increases. It is essential that TDY concentrates on achieving cost savings and improving productivity in the short to medium term and avoids the temptation to pass on the cost of inefficient working practices to its customers by increasing tariffs.

# 1. Introduction

The project for the restructuring of Turkmenistan Railways (TDY) forms module C of the TACIS /TRACECA Restructuring Study of the Central Asian Railways. The project is being financed and managed by TACIS / TRACECA in collaboration with the European Bank for Reconstruction and Development.

Turkmenistan Railways was established in Nov. 1991, and the network operates a route length of 2,312 km, of which 2,279km are single track and 33km are double track.

Turkmenistan Railways has experienced a steep decline in freight traffic since 1991,which, combined with inadequate tariff adjustments, has caused real revenues to decline. The scarce availability of foreign currency has prevented spare parts provision and resulted in a backlog of repair and general overhaul, in particular for locomotives, freight wagons and track.

The dramatic fall in railway freight traffic since 1991 and the continuing decline of the country's economic activities, appear to have focused the government increasingly on restructuring the railway.

The Inception Report on the project was presented at the end of September 1997. This Draft Final Report presents proposals for a new operating concept for the TDY designed to improve its performance and efficiency over a long period. It will be necessary to adjust the system to bring it into line with the demand and to concentrate on the types and volumes of traffic which the railway can handle most economically. Substantial investment will be required to upgrade the system and its infrastructure.

# 2. State / Railway Relationships

## 2.1 The need for external restructuring

The internal reorganisation of TDY as proposed in Chapter 3 of this report will not be sufficient to prepare the present railway administration of Turkmenistan for the future challenges. As was the case with railways in most Western European countries Turkmenistan Railways need entrepreneurial autonomy in order to survive and perform well in the arising national and international transport market. This can only be achieved if the relationship between the state and TDY is completely reshaped. We call this the external reform of TDY. A number of good reasons can be given to the Government of Turkmenistan why the ongoing discussion of the draft for a new railway law should be used to get the reshaping process started.

## 2.2 Appraisal of present situation

### 2.2.1 Need to save public money

Turkmenistan 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.

### 2.2.2 Need to attract private capital

It would also be a relief for the government budget if private capital could be attracted to investing into some of the rail activities. Prerequisites for interesting private capital are efficiency and business profitability or at least a solid prospect for it. This prospect does not exist for the moment as there are doubts about micro-economic profitability of large parts of TDY's traffic. Private risk capital cannot be attracted as long as TDY is maintained as a government administration.

### 2.2.3 Present monopoly position of TDY will not last

The present situation could lead the transport policy deciders in Turkmenistan to the conclusion that external restructuring of TDY is not urgent. It is true that TDY has not only a rail traffic monopoly but a factual monopoly, at least in the sector of long distance traffic in general. In freight traffic for example, TDY performed 89.9 % of all the tkm in the country, as indicated in Appendix 1. This means that it can hardly be spoken of as a transport market in the sense that there is real competition between the modes with regard to quality and price, as is the case in all West European countries. Also railway freight rates and passenger fares seem generally lower than the rates of road transport, at least in the medium and long distance traffic.. For many international freight transports the railway is presently the only possible mode. Numerous obstacles prevent the shippers from using road transport, especially on the route through Kazakhstan and Russia.

However, the situation will change in the coming years. Market economy will be introduced, road infrastructure will improve essentially under the pressure of the owners of private cars, and the emerging freight truckers will take advantage of this, and - as the experience with other countries of the former Soviet Union shows - real competition for the railways will arise. A clear tendency can be stated when looking at the development of the modal split from 1991 to 1996 .

It is therefore in the interest of the Republic of Turkmenistan that TDY, as an energy-efficient and environmentally-friendly means of transportation with an extremely high rationalisation potential, **will be** prepared for the coming changes. It is an advantage that this has not to be done in a rush but in carefully planned steps, and the present strong position of TDY can be used to consolidate the future. Restructuring has to start now.

### 2.2.4 International dimension

Railway transit through Turkmenistan will underlie heavy competition by other modes and by routes through other countries. In order to survive in this difficult market it will not be sufficient to offer a high technical standard in the fields of infrastructure and rolling stock. Also a customer-oriented and service-minded high quality organisation will be needed to an extent which can in no way be ensured by a government administration. The globalisation of competition, not only in the sector of agricultural and industrial products but also in the service sector, does not allow of postponing the necessary reform.

### 2.2.5 Privatisation or corporatisation ?

The further development of TDY and the reshaping of the relationship between TDY and the government will have to take place within the larger environment of Turkmenistan's situation in general and its economy in particular. This environment has to be reform-friendly. In other words, it would be premature to push TDY into an isolated privatisation process without having similar development in the other branches of the economy. Turkmenistan seems far from having a market economy. Its backbone economic activities are presently to a very large extent government driven and controlled.

This is the reason why out of the two options

a. privatise the railway and then make it efficient, or
b. make the railway efficient and privatise it perhaps at a far later stage,

we recommend the second solution and propose the corporatisation of TDY as described below.

## 2.3 Policy Issues

### 2.3.1 Issues identified

Comparing the present situation of TDY with the objective of transforming it into a commercially-acting, market-driven and financially-self-sustaining organisation, it is evident that a certain number of issues have to be solved in the restructuring process.

### 2.3.2 Problems of a government managed enterprise

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 on the market, safety control, regional development, social welfare etc.

### 2.3.3 Incompatibility of government's and railway's interests

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 obey to the rules of the rising transport market.

### 2.3.4 The problem of public service obligations

Public service obligations (for example extremely low tariffs) are imposed on TDY in the general interest of the country but financially they are not always compensated sufficiently. This does not make it a priority for TDY 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 show disastrous results for the railway enterprise.

## 2.4 Proposals for a new State/Railway Relationship

### 2.4.1 Principles for a new framework

As was the case in West European countries before the restructuring of their railways, it seems that the Turkmenistan Government plays a multi-functional role vis-a-vis TDY, 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 organisation;
- the financing body of large parts of TDY'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 administrative 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 the question as to whether TDY 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 TDY 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.

### 2.4.2 The remaining role of government

The remaining role of government would be that of

a) the owner, limited by corporation law,

b) the railway sector supervisory authority, particularly concerning safety, guaranteeing fair competition between the modes, licensing railway enterprises and deciding on transport policy in general,

c) the purchaser of all services which are in the global interest of the Republic of Turkmenistan and defined in private law contracts between TDY and the purchasing bodies,

d) the provider of finance for the investments into the transport infrastructure of the country on an equal basis for all transportation modes.

It is also recommended that not all of the remaining state functions should be performed by the same government body, like for example the Transport Ministry, but by several. Thus,

function a) should be in the responsibility of the State property Ministry (or similar),

function b) in that of the Transport Ministry,

function c) in that of the bodies deciding about services in the general interest like the Ministries responsible for social welfare, defense, regional development etc. using their own budget respectively for the purchase of the services, and

function d) in that of the Transport Ministry and the Finance Ministry.

### 2.4.3. The role of the state with respect to infrastructure

As proposed already, the state will keep a public service responsibility in the field of infrastructure investment. It is recommended that the government - according to the budget possibilities and the criteria of fair and equal treatment with respect to other modes - will assist in financing TDY's investments into infrastructure. If an investment required by the government for its own or community reasons does not show any precalculated profitability in TDY's view, the latter must be allowed to refuse it. The government can of course finance the investment - and the other expenditure resulting from it - on its own.

All other investments, particularly into the rolling stock, have to be financed by TDY itself.

When creating the new Railway Corporation it has to be made sure that the government as the owner not only provides for a good juridical start but also for a healthy capital basis which will permit a normal investment policy.

### 2.4.4 The role of the state with respect to over-staffing

Over-staffing has been a major problem of most railways all over the world. TDY is not an exception. As mentioned earlier in this report both passenger and freight traffic have immensely decreased since the breaking up of the Soviet Union. Although this negative development seems to have come to a halt in the recent past and although international freight traffic particularly has started to grow again to an encouraging extent, it would be an illusion to think that, under normal circumstances, figures of former decades could ever be reached again.

As the cost structure has not followed the decline of traffic and revenue, all necessary and possible measures to adapt the railway organisation have to be undertaken. Next to the other restructuring measures, staff reduction has to go on as staff costs represent a large part of the total cost of the enterprise. It is true that from the 35000 staff in 1991/92 a number of roughly 22000 has been reached at the beginning of 1997. But the consultant has the impression that this is mainly due to the transfer of health care and educational services to other Ministries and to smaller reductions of administrative staff in the central offices. The consultant was told that no essential staff reduction has been undertaken in the field.

It must be recognized, however, that in the present economic and social situation of Turkmenistan and according to the consultant's experience with other countries, it is impossible to take measures which are too radical in this respect. On the other hand, this social problem cannot be left as a burden solely on TDY because the real cost structures would be falsified in that case, and for a commercially acting corporation there is nothing worse than lack of transparency and unjustified over-costing.

In reality it is the task of the state to deal with this social problem and if the state wants to use TDY as an instrument to solve it then this is a good example for a service in the public interest which has to be compensated financially by the government. On behalf of the state TDY can and should of course put up a program of financing early retirement, training and retraining etc. and contribute actively to further possible solutions. But if the new corporation is to be given a fair start, it must be done without this financial burden.

As a means for solving the overstaffing problem we recommend the immediate introduction of a ban on recruitment. On the other hand we acknowledge that existing staff cannot be completely retrained and that in certain sectors, as for example in information technology, young specialists have to be hired.

Therefore we advise that exceptional recruitment must remain possible, but must underlie a precise justification procedure with at the end of it the agreement of the highest possible authority.

## 2.5 Performance Agreement

The general purposes of TDY will be defined as:

- The operation of a railway on the Turkmenistan 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 **Performance Agreement** agreed between the government and TDY, which will include the following provisions:

- Period of Agreement (five years would be reasonable);
- Use of state owned property ( land, buildings, equipment, etc.) by TDY, 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 TDY with focus on provision of passenger and freight services, renewal of infrastructure, financial management and restructuring.

The Performance Agreement will contain the following provisions:

- **Mission Statement** for TDY, to be set by the government and agreed by the Railway.

- **Strategy,** which is the framework for achievement of TDY's Mission.

- **Specific Objectives,** 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 Appendix 2

### 2.5.1 Further restructuring options proposed - third party access.

As the political aim should not be to privilege TDY and maintain it in the status of a 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 but to operate freight and passenger trains on the main network. There they would be in competition with TDY. They would have to pay the same user fees as the operating Business Units of TDY and should not be discriminated against 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 in any case be made possible. Services in the public interest as mentioned above could in that case be purchased by the responsible government bodies through a tendering procedure in which the winner would be the tenderer with the lowest need of government money and the best offer as far as quantity and quality of the performance is concerned.

### 2.5.2 Accompanying measures needed

It is recommended that other modes, particularly road traffic (private car and truck) should bear infrastructure costs to the same extent as the railways in the medium and long term. This could be achieved via the existing road tax, a fuel tax or other means of taxation. External costs should for all modes be included as far as possible in order to avoid wrong allocation of scarce investment money in the interest of the country as a whole. Government should not wait to become active in this respect until it is too late, i.e. until the road transport interests have become so powerful that it will be difficult - as this has become the case in Western Europe - to guarantee equal treatment of all modes. In the case that for example road traffic will be privileged in one way or the other, the government will have to subsidise the railway infrastructure correspondingly. At any rate, the environment friendliness of the railway mode and the relatively enormous external cost advantages (noise, pollution, need of land, energy consumption, accidents etc.) have to be taken into account.

# 3. Internal re-organisation of TDY

## 3.1 Introduction

The re-structuring of TDY cannot be achieved satisfactorily unless a new management organisation structure is put in place. The present organisation served well over the past few years since the break-up of the former Soviet railway system and laying the basis for a separate independent national railway administration of Turkmenistan.

As has been underlined earlier many reasons plead in favor of adapting the existing organisation to future needs and challenges. TDY must urgently be made more efficient and customer - oriented, must reduce its production costs and reach a higher degree of transparency in its decision making process in order to be prepared for the rising transport market in an increasingly deregulated economy.

It is generally considered desirable to have separate funding, accounting and management for infrastructure, which is seen as a public-funded asset, in the general interest. There is a need for greater commercial freedom and separate accountability in the provision of passenger and freight services. There is a growing trend internationally to consider third party access to national rail systems. Although this is unlikely to be a short term requirement for TDY, it can be considered as a real longer-term possibility, given the increasing volume of international transit traffic through Turkmenistan, and the general tendency of replacing monopolies by competitive systems leading to cost reducing pressure as well as better performance and innovation.

## 3.2 Present organisation structure

The present organisation structure of TDY shown on the chart in Appendix 3 is characterised by a strict top down management, the top being the Cabinet of Ministers. It appears to leave hardly enough flexibility margin for business management at the Director General level, and even less farther down the hierarchy. Except for minor changes, this seems the case for all organisational measures, such as the fixing of tariffs, rates and fares, decisions concerning investment priorities, staff numbers etc..

The railway organisation is formally headed by the Director General who coordinates the different services. These are grouped on a purely functional basis.

The most important administrative units are headed by
the First Deputy DG, with under his direction the

- Commercial Director
- Locomotive Director
- Wagon Department
- Statistics Department

the Chief Engineer, with under his direction the

- Capital Works
- Technical Services
- Emergency Services
- Traffic Security ( policing/safety )
- Track Maintenance Department
- Signalling, Telecommunications, Accounting Machines

- the Chief Economist, with under his direction the
  - Finance Department
  - Planning Department

Other services directly subordinate to the Director General are the

- Human Resources Department
- Passenger Department
- Legal Department

The present organisation is a traditional functional type with the advantages and disadvantages associated with it. It is largely influenced by the existing state-railway relationship.

At present 53 formally separated enterprises with different legal status are active in the framework of TDY. They are scattered all over the organisation at different levels. The enterprises seem all strictly subordinate to the TDY administrative hierarchy with respect to matters of finance, staff, procurement etc. and to the same top -down regime as the core railway organisation.

The regional administration was described to us as being centered in the cities of Turkmenbashi, Mary and Chardjev, whose services are subordinate on one hand to the different HQ-departments in Ashgabad, but also to the coordinating regional director on the other hand. Local functional units can be found on the executive level.

There is significant scope for rationalisation of activities and functions within the presentstructure. Re-organisation can, above all, lead to more transparency in the management process and define responsibilities better. The establishment of a new relationship between state and railway organisation as proposed above is, however, a prerequisite for a successful re-organisation.

It seems that, below the Director General level, responsibilities for the most onerous functions are concentrated in the hands of three leading managers and the question is whether under these circumstances delegation of power to lower levels is possible and to what extent it could be put into practice.

Though the organisation of TDY could be significantly improved, while retaining a functional structure, we do not consider that this approach would be sufficient to meet the coming needs. Our proposals for a new organisation are based on a new type of structure, which will provide a firm foundation for the future development of TDY.

## 3.3 Organisation principles and trends

Traditionally railways all over the world have in the past organised their management structures on functional principles. This involves grouping activities according to their different functions. A functional approach to organisation has also been common in many other types of enterprise. Manufacturing companies, for example, frequently organise their activities around marketing, engineering, production and finance.

The functional principle of organisation is a well-proven management system. It provides for strong centralised top-down management and control as is presently the case with TDY. It makes efficient use of people and their specialised skills, and facilitates training and development of staff. It provides a logical basis for allocation of separate functional responsibility.

However, a functional-type organisation structure also has certain disadvantages which become all the more evident as well defined business responsibility decides about success or failure in a market-driven economy. Functional departments can become too focused on their own specialty and fail to act in a way which achieves the overall objectives of the enterprise. Departments can become over-specialised, uncoordinated with other departments and resistant to change. Only the Chief Executive can in that case be held responsible for profit performance, and this is an unnecessary and inconvenient high level of hierarchy.

In order to overcome the disadvantages of the functional type of organisation, many enterprises now organise their management structures on the basis of product or service. The Chief Executive can delegate responsibility to product managers whose units are largely functionally self-sufficient and who can therefore carry real profit responsibility. The contribution (in profit or loss) of individual products or services can be more readily identified at corporate level.

There is a more recent development of the product-type organisation, which has proved very effective. This involves the creation of Strategic Business Units (SBUs) within the enterprise. SBUs have their own product or service line, have their own marketing, sales and production, their own regional and local management representation, with real profit responsibility. They develop their own missions and goals, within the framework of the corporate mission , and prepare their own strategic plans. SBU managers are expected to have the drive and entrepreneurial skills of the manager of a private business.

Many railways all over the world are re-organising at the present time. Most - and not only in Western countries - are moving away from functional organisations to a greater or lesser extent. Great Britain has established separate private companies providing the various services. Sweden has transferred infrastructure to a separate state administration, and the rest of the railway is divided into business units covering passenger and freight operations, rolling stock maintenance and property. Both the Netherlands and Spain are moving to a structure based on strategic business units, one each for the passenger and freight businesses, infrastructure, rolling stock maintenance, and property; the Director General co-ordinates the activities of the business units, supported by a small headquarters group. Germany has restructured its railways in a similar way; from 1998 the business units will be developed into separate limited stock companies coordinated by a management holding; it has opened the infrastructure for third parties that have the same rights and obligations as the national railway's own freight and passenger business units.

## 3.4 Proposed organisation structure

### 3.4.1 Overall structure

Our proposed structure shown on the organisation chart Appendix 4 is based on the principle of separate Business Units for passenger and freight services which are the main commercial activities of TDY, as well as for infrastructure management and traction/heavy maintenance of rolling stock. The separate establishment of the Infrastructure Business Unit will introduce costing transparency in this sector and will facilitate potential third party operator access in the future. The creation of a Business Unit for Rolling Stock will make it easier to receive orders from third parties for provision of services at a profit and to invite private capital to participate in a joint venture later.

We propose that many functions be devolved to the SBUs; however there are other tasks which should be retained at TDY headquarters outside the Business Units because they can be provided centrally more economically and effectively, or because they are essential to enable TDY to operate as a single corporation. For this purpose we recommend the establishment of two Units, for Corporate and Administrative Services respectively.

Each Business Unit should be responsible for its own marketing and sales, be they performed within or outside the corporation, for the operation of its services, the management of its own staff and its own accounting and controlling. This will create specific cost consciousness, will allocate profit responsibility to each Business Unit for the services it provides, and also give control over the resources it needs to achieve profitability. Each SBU will operate very much like a private commercial company. The guiding principle for a new organisation structure in detail must be that the Business Unit management has a maximum influence on the development of costs related to its performance output. Another leading principle to be applied is that decisions should be taken as far as possible at the level on which the value is added.

We propose that each of the Business Units and the Service and Headquarters Units be led by a Director. These six Directors, under the Chairmanship of the General Director, will constitute the Executive Board. The Executive Board should meet regularly in order to co-ordinate the activities of TDY.

The Executive Board - chaired by the Director General - will be the supreme executive organ responsible for overall direction of TDY in accordance with the corporate mission, strategy, policy and budget as established by law or as agreed with the Cabinet of Ministers.

The Executive Board will coordinate the activities of the four Business Units and the two Services Units, monitor their performance and take corrective action where necessary.

The services which we propose to be grouped in the Corporate Services Unit are:

- Corporate Planning,
- Finance & Controlling,
- Computer Systems,
- Procurement and Real Estate.

For the Administrative Services Unit we propose:

- Organisation,
- International Relations,
- Human Resources,
- Legal Services and Audit.

### 3.4.2 Freight Business Unit

The Freight Business Unit will have its own marketing and planning, sales, stations as well as operating and technical, finance/controlling/administration and human resources functions with corresponding managers. It will develop and sell freight services in the national and international markets. It will operate its own wagon fleet and undertake routine maintenance. It will employ, manage and develop its own staff. It will prepare its own financial plans and budgets, and define its products/services. It will operate as a self-contained business with profit responsibility, within the overall corporate goals and strategies of TDY, and in collaboration with the other Business and Services Units in TDY.

The Unit's main functions will be :

- transport of goods in a safe, reliable, cost effective and profitable manner
- fixing of tariffs and rates
- development and marketing of logistical systems
- development of combined transport
- expansion of transit traffic and liaison with foreign customers, shippers and ports
- management of the assets like stations and freight terminals
- management of wagon fleet including routine maintenance
- purchase from the Rolling Stock Business Unit for supply of locomotive services
- as well as overhaul and major maintenance performances in accordance with best
- commercial practice, but with the right to tender these services
- realisation of financial and other targets set down at TDY corporate level

The proposed organisation structure for the Freight Business Unit is shown in appendix 5.

### 3.4.3 Passenger Business Unit

Like the Freight Business Unit, the Passenger Business Unit will be independent and self-contained. It will be structured in a similar way with managers responsible for marketing and planning, sales, stations, operating and technical, human resources and finance /controlling /administration.

The main functions of the Passenger Business Unit will be :

- provision of cost effective and safe public passenger transport in the form of long distance (national and international) and commuter service with the goal of profitability
- ticket pricing and fare structure
  development of attractive future-oriented services for passengers
- management of the assets, particularly the passenger stations
- management of coach fleet including routine maintenance
- purchase of traction and coach heavy maintenance from the Rolling Stock Business Unit, but with the right to tender these services
- realisation of financial and other targets set down at TDY corporate level

The proposed organisation structure for the Passenger Business Unit is shown in appendix 6.

### 3.4.4 Infrastructure Business Unit

We propose that all infrastructure activities and functions should be grouped together in an Infrastructure Business Unit. This will facilitate separate accounting for the infrastructure and its separate funding from public sources and thus make it much easier to prevent cross-subsidisation between the different functions in the Corporation. This is very much in line with international trends whereby the provision of the infrastructure is seen, on principle, to be a public service in the same way as is available for the competing modes. This facilitates an equal treatment of all modes and thus permits harmonisation of competitive conditions. When making contributions to the funding of transport infrastructure the state has the possibility and the obligation to take account of the social costs (pollution, accidents, energy provision etc.) caused by the different modes. It can privilege investments into the infrastructure of those modes which produce advantages for the country as a whole.

The establishment of a separate Infrastructure Business Unit will also facilitate charging for use of the infrastructure and access of third party operators, if that is considered desirable at some time in the future.

The Infrastructure Business Unit will be self-contained with its own managers for planning and for sales of train paths, for path management and operating, construction, track maintenance, signalling and communications, human resources, and finance/controlling/administration.

The Infrastructure Operations Manager will carry responsibility for central dispatching, controlling track capacity and train running for both passengers and freight. He will be responsible for the overall timetable and will have a neutral position with respect to selling train paths to the Freight Business and Passenger Business Units of the Corporation or to third party operators.

The main functions of the Unit will be :

- provision of a safe, high quality infrastructure system
- maintenance of the system in the most cost effective manner
- development of an infrastructure plan and of the corresponding implementation strategy in harmony with the TDY overall corporate plan
- marketing of train paths with the minimum goal of covering the infrastructure costs not taken care of by government's public service subsidies
- realisation of the financial and other targets set down at TDY corporate level

The proposed organisation structure for the Infrastructure Business Unit is shown in appendix 7.

### 3.4.5 The Rolling Stock Business Unit

We propose the establishment of a Rolling Stock Business Unit to deal with traction/heavy maintenance which will carry out major maintenance and overhaul work for the Passenger and Freight Business Units on locomotives, passenger carriages and freight wagons. It will also manage the locomotive fleet. It will operate as an autonomous enterprise with its own workshops, locomotive depots, human resources and finance/controlling/administration functions. It will contract with the Passenger and Freight Business Units and may subcontract some of the work to outside workshops.

The Rolling Stock Business Unit will be encouraged to compete for engineering work, and should have the potential to win profitable business from operators of industrial railways, from railways in neighboring countries and other industrial customers.

The principal functions of the Unit will include :

- heavy maintenance of rail rolling stock in a cost effective manner
- development and improvement of the engineering workshops

- sales of overhaul, maintenance and other engineering services as well as traction to the other Business Units of the Corporation and to external customers
- realisation of financial and other targets set down at TDY corporate level, the goal being business profitability for the Unit

The proposed structure for the Rolling Stock Business Unit is shown in Appendix 8.

### 3.4.6 Corporate Services Unit

The Board of TDY - chaired by the Director General - will have overall responsibility for the performance of the Corporation and the coordination of the Business Units, The Board and its individual members, as General Managers of their respective Business Units will be assisted in their tasks by two Services Units, also headed by members of the Board. These Units will supply services that are more economic to provide centrally rather than be duplicated in each of the Business Units, or that are necessary for ensuring the unity of the Corporation.

The grouping which we propose is in our view a rather logical option. Nevertheless we consider that there could be other viable solutions for distributing the services between the two Units.

We propose that the Corporate Services Unit will be responsible for :

- corporate planning, which will draw together the plans of the Business Units, ensure that they are in harmony with overall TDY objectives and with each other, and present the overall TDY corporate plan. Included in this function are economic studies and forecasting
- computer systems, information technology and data network services
- finance and controlling, providing financial accounting, budgeting, treasury and funding services, monitoring of capital expenditure
- procurement which will set the purchasing procedures for all Business Units, and carry out purchasing of designated items
- real estate which will develop property and optimise use and financial return on TDY properties

The proposed structure for the Corporate Services Unit is shown in Appendix 9.

### 3.4.7 Administration Services Unit

We propose that the Administration Services Unit will be responsible for :

- development of the overall organisation structure of the Corporation
- international (bilateral and multilateral) relations including memberships of TDY in international organisations, translating and interpreting functions
- human resources, setting overall TDY policies and procedures on human resources, and providing central pay negotiations, training and other services
- legal services, ensuring compliance with all legal requirements and providing contract drafts
- internal audit, providing internal financial monitoring and ensuring the integrity of TDY's systems and procedures

The proposed structure for the Administration Services Unit is shown in Appendix 10. These proposals will provide an optimum balance between the functions devolved to the Business Units to enable them function in an efficient commercial manner, and those functions properly retained at an overall level to maximise the benefit of TDY's corporate identity, synergy and strength.

### 3.4.8 Other services

#### 3.4.8.1 Secretariat of Director General

We propose that the Head of DG's Secretariat - directly subordinate to the DG - will have the following main functions :

- Support the Director General in his coordinating activity within the Board
- Support the Director General when representing the Corporation outside
- Ensure smooth and effective functioning of the Board
- Coordinate the activities of the assistants and secretaries within the DG's Secretariat
- Advise the DG and the other members of the Board in matters of protocol

#### 3.4.8.2 Press and Public Relations Service

We propose that the Head of the Press and Public Relations Service will be directly subordinate to the DG and have the following main functions :

- Close relationship with press, broadcasting and television
- Ensuring corporate identity and positive general image of TDY
- Publishing and distribution of material concerning the corporation
- Taking care of national visitors

#### 3.4.8.3 Ancillary services

Where appropriate, ancillary functions can of course - and this is strongly recommended - be taken over on the national, regional or local level by subsidiary companies under the condition that they are attributed full commercial autonomy as well as result responsibility and that they are financially self-standing which means potentially profit making. Every subsidiary company should be attributed to one of the Business Units.

#### 3.4.8.4 Regional and local level

General administrative levels as far as they exist on the regional and local level, should be eliminated. Every Business Unit will decide about its own regional and local organisational needs (regional and local offices) and manage them directly.

#### 3.4.8.5 Ancillary enterprises

The existing 53 ancillary enterprises should be fully integrated into the Business Units in order to streamline the whole of the corporation. This does not prevent the management in any way from keeping them separated as strictly supervised cost units on the accounting level.

## 3.5 Management relationships within TDY

It is recommended to create a selling/buying relationship between the Business Units.

One of the main selling/buying relationships will be the one between the Freight and Passenger Business Units on one hand and the Infrastructure Business Unit on the other. The latter will be responsible for a well functioning railway network, setting up train paths and selling them to the former, who will pay user fees on a train-km basis.

In the same way, traction services and services of heavy freight wagon and passenger coach repair will be sold and bought.

## 3.6 Implementation plan

The task of changing the organisation structure to the proposed new structure is a very significant one. The change must be carefully planned and will require the full commitment of the Director General and the other members of the Executive Board.

We are proposing the establishment of a Re-organisation Task Force under the direction of the Director General, with responsibility for planning and coordinating the implementation of the new organisation structure. Each member of the Board will establish for his Business or Services Unit a change team which will carry out the changes required, under the overall direction of the Re-organisation Task Force.

We anticipate that the proposed changes can be fully implemented within three years, although transition solutions might be necessary in some cases.

The members of the Re-organisation Task Force should include representatives of each Business and Services Unit, assisted by an expert consultant facilitator respectively.

The objectives of the Re-organisation Task Force would be to :

- develop a master plan for all the activities that must take place over the entire re-organisation implementation period
- issue guidelines to the Change Teams in each Business and Services Unit
- coordinate and approve the plans of the Units' change teams
- monitor and report to the Executive Board on progress. Amend plans as necessary
- assist the Unit Change Teams in resolving difficulties that may arise, and in taking corrective measures to maintain the momentum of change

The Unit Change Teams should contain representatives from the main functional areas in the Unit. The Unit General Manager may chair the Team or delegate the chairmanship to a competent senior manager. In any case the Change Team will be responsible to the Unit General Manager, subject to the coordination of its work by the Re-organisation Task Force.

The objectives of the Change Teams will be to :

- develop detailed implementation plans for their individual Units
- ensure that the individual Unit plans are in harmony with the overall re-organisation plan and with each other
- submit plans for approval to the Re-organisation Task Force and report on progress

The relationships between the Re-organisation Task force and Unit Change Teams are shown in Appendix 11.

## 3.7 Further restructuring options

### 3.7.1 Attraction of private capital

It would be an advantage for TDY, as well as a financial relief for the government, if private capital could be attracted to the railway business. It can be thought of as joint ventures in future subsidiaries of the Business Units as mentioned above, particularly in the fields of Combined Transport, and Container Traffic, where opportunities will arise for financing and operating modified rolling stock, and developing and planning suitable depots and handling systems. Similarly in the area of infrastructure, there are many opportunities for joining with private companies in maintenance of track and signalling. In the rolling stock area there are many possibilities to enter into joint ventures in maintaining the rolling stock fleet for TDY and for selling on surplus capacity to neighboring railways.

Examples in the field of passenger traffic are :

The use of railway real estate (for example a railway station) by a joint venture - TDY bringing in the building and the surrounding area and the private investor financing the refurbishment of the station and bringing in the management know-how could lead to profitable business through establishment of shops, restaurants, cinemas etc. by small entrepreneurs.

The other example would be a hotel joint venture to which TDY would contribute the construction ground near the railway station and the possibility to make hotel reservations through the general railway reservation system, and the private partner would finance the construction of the building and contribute the hotel management know-how.

### 3.7.2 Tendering procedures

As soon as TDY acquires a private legal status, it should rapidly introduce tendering procedures in the field of procurement of products and services. Competition between providers within Turkmenistan and/or foreign providers should be used to maximum advantage of TDY with the aim of reducing costs.

### 3.7.3 Outsourcing

TDY's Board should be given the task to permanently take into consideration the possibility of purchasing services from third parties instead of producing them within TDY. There should be no ideology playing any role in this respect; only thorough calculations undertaken case by case will show the financial advantages or not of outsourcing.

# 4. Legal Framework of Turkmenistan Railways

## 4.1 Introduction.

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, was carried out by the legal expert, as his main task.

## 4.2 Legal Framework - Summary.

### 4.2.1

Railways in Turkmenistan 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 and the Cabinet of Ministers the developments since independence are described in outline in this report.

### 4.2.2

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

### 4.2.3

Following independence, the strategic state enterprises were placed under the control of the government. In or about 1992/1993 the name was changed to Turkmen Demir Yollari ("TDY"). On 6 March, 1994, the President, by Decree[1] approved a Charter for TDY. It stipulated that TDY is a juridical person[2]. The Decree subjected TDY to the Constitution and legal system of Turkmenistan[3]. The main objectives of TDY were set out[4]:

- provision of a safe efficient railway;
- study of railway transport requirements;
- planning improvements;

The Chief and First Deputy Chief of TDY are nominated by the President of Turkmenistan[5]; other senior personnel are nominated by the Chief of TDY in co-operation with the Cabinet of Ministers and appropriate Hakimlik (Municipal bodies)[6].

The Charter does not provide a high degree of autonomy for TDY; it remains very much a part of the state system

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1 Decree No. 1709
2 *ibid.* Regulation No. 10
3 *ibid.* Regulation No. 2
4 *ibid.* Regulation No. 3
5 *ibid.* Regulation Nos. 5 & 8
6 *ibid.* Regulation No. 8

### 4.2.4

The existence of a Draft Law (Code) on Railway Transport is a positive indication of recognition by the Government of the need to provide an effective legal environment for railway transport in Turkmenistan.

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

## 4.3. Monopoly and Price Control Issues

Internal passenger and freight tariffs are determined by TDY and submitted for approval to the Cabinet of Ministers. A common international tariff applies within the CIS countries agreed at international conferences.

## 4.4. The Railway Law

### 4.4.1

Previous consultants produced a draft for a railway code which was intended for use as a standard model for the central Asian countries. This has not been adopted by the Government of Turkmenistan.

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.

### 4.4.2

A draft law (code) on railway transport was submitted to Parliament in September, 1997. It is not possible to say at this stage how long the legislative process will take; one may assume that amendments will be made to the draft before enactment.

From the positive beginning which the draft law represents, further progress may be achieved by making further refinements and amendments and introducing new provisions before it is enacted into law.

An examination of the draft law disclosed a number of matters requiring comment in this report. The draft in general is progressive but consideration might be given to providing for a competitive rather than a monopolistic railway system.

#### 4.4.2.1

The intention appears to be that what would normally be regarded as the railway infrastructure will remain the property of the state[7], as is the case in many western countries. This could be further clarified by including a definition for "railway infrastructure".

7 Article 4

### 4.4.2.2

The draft law provides for the establishment of TDY as an organ of the state for the discharge of the state management function[8]. It lists the functions of TDY, which take the form of a fusion of the roles of the state and the railway. An alternative approach would be to define the role of the state, being essentially supervisory, strategic and policy making, and allow for TDY and other railway enterprises to operate as providers of railway transport services in competition with one another driven by commercial considerations.

### 4.4.2.3

Provision is made for state and local authority joint decisions on opening and closing railway stations[9]. 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 a decision to close uneconomic stations imposes additional costs.

### 4.4.2.4

The draft law anticipates access by third party operators to the railway infrastructure; however it does not anticipate these operators operating their own services on the railway infrastructure or give any protection to them against abuse by TDY of its monopoly position. The draft law could be amended to specify a procedure for an operators licensing system based on the competence and financial resources of applicants.

### 4.4.2.5

The draft law envisages tariffs being set by order of the Cabinet of Ministers[10]. This function might be given to a specific railway transport division of the Cabinet of Ministers (see below).

### 4.4.2.6

Customer complaints are dealt with solely within the context of a legal structure[11], which leaves the customer at considerable disadvantage. Level of customer satisfaction might also be perceived as a measurement of satisfactory performance of the railway function - as would be the case in a commercial enterprise. This could be dealt with in the context of a "performance agreement" approach to the relationship with the state railway - see recommendations below.

## 4.5. Recommendations

### 4.5.1

The Charter of TDY should be amended to transform TDY into a State owned joint stock company (or a corporation which resembles a joint stock company) with a Chairman and Board appointed by the President and where applicable the appropriate State authority; the Board in turn should appoint the Chief Executive and the senior management who should report directly to the Chief Executive. The Chief Executive and the senior management, as appropriate to meet each particular situation, should appoint other TDY staff. The focus of TDY should be that of a commercial enterprise, consistent with the strategy, policy and objectives of the State relating to railway transport.

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8 Article 5
9 Article 9
10 Article 22
11 Article 27

### 4.5.2

The pending enactment of a Railway Law 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 the draft should be revised, addressing the following issues:

#### 4.5.2.1

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

#### 4.5.2.2

In the case of TDY 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 TDY and from the administrative and economic control and internal accounting of the state (but under the general supervision of the state), and managed according to the principles which apply to commercial companies.

#### 4.5.2.3

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 TDY 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.

#### 4.5.2.4

It should require that the accounting system of TDY 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 TDY would meet this purpose.

#### 4.5.2.5

It should facilitate the corporatisation of TDY.

#### 4.5.2.6

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 TDY (into the infrastructure fund).

#### 4.5.2.7

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

#### 4.5.2.8

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.

### 4.5.2.9

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

### 4.5.2.10

It should define the role of the state and establish a division within the Cabinet of Ministers - perhaps called the Railways Department - exercising on behalf of the Cabinet of Ministers the following functions :

- entering into agreements with TDY 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 TDY 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 TDY and monitoring compliance; in this connection it is believed that if TDY 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 ;
- specifying the form of accounts to be maintained by TDY 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 non-discriminatory vis a vis TDY and other users.

### 4.5.3

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

### 4.5.4

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.

### 4.5.5

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

# 5. Traffic and cost analysis

## 5.1 Economic context

### 5.1.1 The local economic context

To analyse Turkmenistan Railways' operating costs and traffic, a brief study of the country's economic context is required.

Regardless of the country, railway networks have two characteristics:

- They are more or less defined as monopolistic entities. The monopolistic situation of Turkmenistan Railways and other railway networks of CIS countries remains very strong as a result of their recent past history. It is however an advantageous situation for railway networks;
- Railway traffic levels are dependent upon the economic context and the country's industrial production levels and this is disadvantageous to railway networks since one of their characteristics is that they cannot rapidly adapt their resources (equipment, rolling stock, staff) to actual traffic levels.

Consequently, any traffic and cost analysis should be placed within the economic context of the country.

The gross domestic product had decreased steadily between 1990 and 1995, by 5% the first year, 10% the second year, 20% the third year. In 1994, the gross domestic product amounted to $222 \times 10^9$ Manats, i.e. $3 \times 10^6$ US Dollars. From 1994 to 1995, a new 20% drop was recorded. In 1996, the context stabilised. In 1997, a further 10 to 20% drop is planned. In March 1997, the Government decided to freeze gas exports, due to the fact that importers were not paying their bills (Caucasus, Ukraine). Such a policy should substantially increase the trade deficit and should reduce raw material imports needed by the country.

Since 1996, the inflation rate seems to be under control. The currency exchange rate between the Manat and the US Dollar was established in 1997 around 5300 Manats for 1 Dollar (380 in 1995, 3250 in 1996).

The legacy of the previous regime is still felt. The legal framework remains vague in terms of land development policy, and water, telephone and gas remain almost free for individual families. Average salaries are still very low (approximately 200,000 Manats monthly, i.e. 40 USD). The Government acts cautiously and the privatisation process seems to be taking a long time. Out of 7,000 small companies listed, only between 2000 and 3,000 have been privatised in the fields of services and distribution. 89 major companies are being privatised or their privatisation is under study. These companies cover mainly textile (excluding cotton manufactures), agricultural produce, construction materials, glass, « Eternit » pipes, concrete.

From an economic standpoint, the country seems to be currently at its low ebb, but no clear sign of recovery is apparent. As a result, no improvement should be expected in terms of railway performance results and a sharp increase in costs should be planned. The situation remains uncomfortable for Turkemistan Railways.

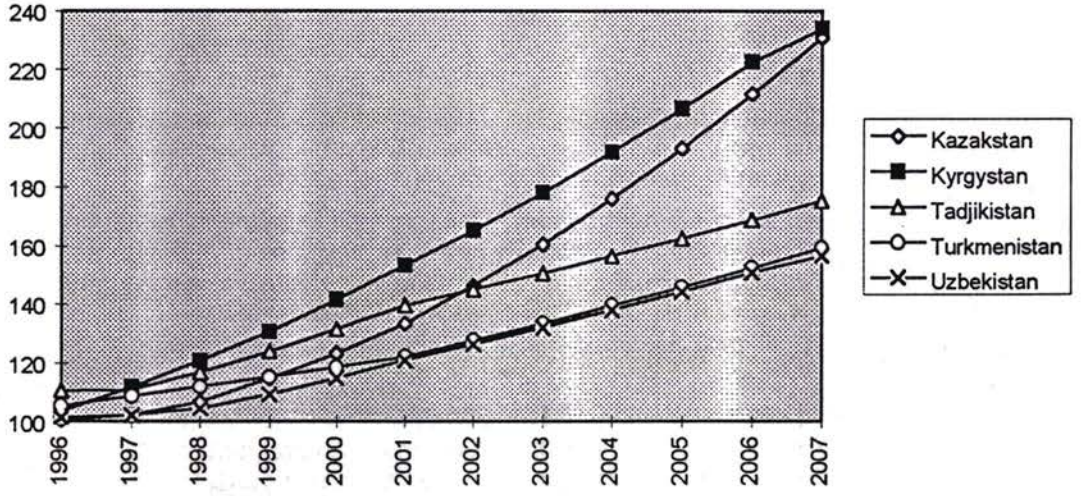
### 5.1.2 Regional economic overview

The following tables show the expected evolution of trade and economy growth in each Central Asian country [12]

12 Source : TRACECA traffic data base, medium scenario.

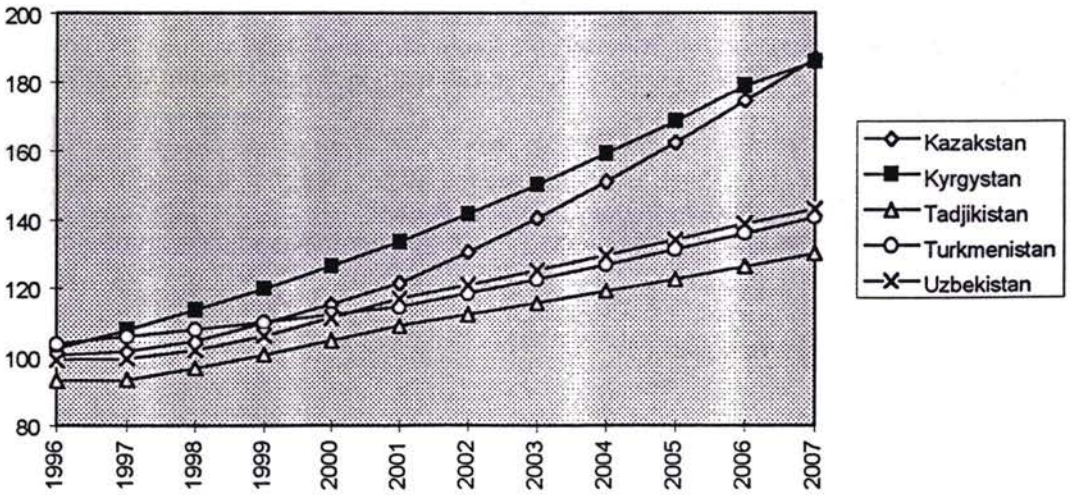
| *Trade growth (in %)* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Kazakstan | 0,60 | 1,64 | 4,47 | 7,45 | 7,45 | 8,20 | 9,68 | 9,68 | 9,68 | 9,68 | 9,68 | 9,03 |
| Kyrgystan | 3,58 | 7,90 | 8,05 | 8,20 | 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 |
| Turkmenista | 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 | 0,76 | 2,24 | 4,47 | 5,22 | 5,22 | 4,52 | 4,52 | 4,52 | 4,52 | 4,52 | 3,87 |

**TRADE GROWTH**
**Base 100 in 1995**




| *Economic growth (in %)* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Kazakstan | 0,40 | 1,10 | 3,00 | 5,00 | 5,00 | 5,50 | 7,50 | 7,50 | 7,50 | 7,50 | 7,50 | 7,00 |
| Kyrgystan | 2,40 | 5,30 | 5,40 | 5,50 | 5,60 | 5,60 | 6,00 | 6,00 | 6,00 | 6,00 | 6,00 | 4,00 |
| Tadjikistan | -7,00 | 0,30 | 3,60 | 4,10 | 4,10 | 4,10 | 3,00 | 3,00 | 3,00 | 3,00 | 3,00 | 3,00 |
| Turkmenista | 3,70 | 2,00 | 2,00 | 2,00 | 2,00 | 2,00 | 3,50 | 3,50 | 3,50 | 3,50 | 3,50 | 3,50 |
| Uzbekistan | -1,00 | 0,50 | 2,50 | 4,00 | 5,00 | 5,00 | 3,50 | 3,50 | 3,50 | 3,50 | 3,50 | 3,00 |

**ECONOMIC GROWTH**
**Base 100 in 1995**



### 5.1.3 The transport sector

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

#### 5.1.3.1 Passenger traffic

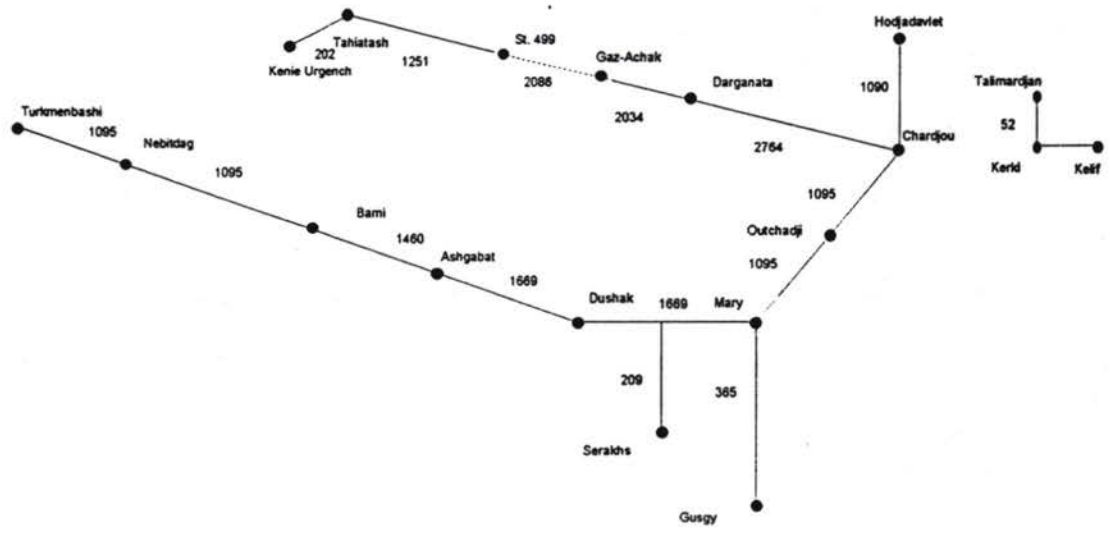
Passenger traffic has reduced significantly in the last years as shown in the next table. The average distance has reduced for international trains but remains steady for commuter and local trains. Overall, the average distance fell from 276 km to 153 km.

| | 1996 (1st Half) | | 1996 (2d half) | | 1997 (1st half) | |
|---|---|---|---|---|---|---|
| | Passengers | Pass.-km | Passengers | Pass.-km | Passengers | Pass.-km |
| | (in 000's) | (in millions) | (in 000's) | (in millions) | (in 000's) | (in millions) |
| Commuter | 1 530,63 | 139,74 | 1 809,42 | 186,56 | 2 189,42 | 193,46 |
| Interurban | 1 900,58 | 759,60 | 1 498,68 | 622,37 | 492,67 | 192,39 |
| International traffic | 558,22 | 205,51 | 476,39 | 189,93 | 423,22 | 91,23 |
| **TOTAL** | **3 989,429** | **1 104,845** | **3 784,498** | **998,859** | **3 105,300** | **477,084** |

The reduction is due to the price charged and the service offered compared to these of the competition.

Today no international Turkmen train leaves Ashgabat. Long distance rail traffic has fallen by nearly 50% every year. Services are slow and not satisfactory in terms of comfort. Frequency is low compared to buses.

The number of passenger trains is shown on the next figure. It must be noted that Uzbek trains on the section starting in Talimardjan are not included.




Passenger traffic is still reducing strongly (more than 20% in Gross Ton Km which means even more in terms of passenger-km) having a strong impact on the overall Gross Ton Kilometres. Profitability of such services is therefore presumed to be even worse than previously. This reduction is even worse when

considering the opening of new lines such the one towards Iran. Passenger traffic between Takhiatash and Kenie Urgench is reduced to zero. Traffic between Kubadaq and Zarpchi is increasing slowly.

Improving revenue through an increase in tariffs has encouraged the transfer of traffic towards other transportation modes. It would be more rational to improve control over expenses and thus help reduce actual costs. The evolution of passenger traffic for 1997 and the increase in tariffs reinforce this type of reasoning[13]

| | | |
|---|---|---|
| on 13/01/94, tariffs are multiplied | | by 2.5 |
| on 01/12/94 | " | by 3 |
| on 11/02/95 | " | by 5 |
| on 27/04/96 | " | by 3 |
| on 01/12/96 | " | by 8. |

These increases may be compared to the inflation rates which were high during those years.

A comparison of prices (in Manats) between train, bus and plane is shown underneath which demonstrates that train tariffs are not competitive in the Turkmenistan transport market sector. Even in the most comfortable types of bus, tickets are cheaper than those of the most economic fares on trains. For longer distances, the price between air and rail is comparable when using a couchette compartment (which is anyway the most common type of coach).

| | TRAIN | | | | BUS | | | PLANE |
|---|---|---|---|---|---|---|---|---|
| From Ashgabat to | Common seat | Reserved seat | Couchettes | Sleeping car | Hard seat | Soft seat | Express | Economy |
| Tedjen | 721 | 1024 | 1616 | 3181 | 2700 | 3540 | 4260 | |
| Mary | 8728 | 1237 | 1962 | 38704 | 4500 | 5940 | 714 | 28500 |
| Chardjev | 1242 | 1772 | 2814 | 55792 | | | | 34000 |
| Dashkhovuz | 1850 | 26885 | 42552 | 84708 | | 3180 | 3180 | 36600 |
| Turkmenbashi | 1242 | 1772 | 2814 | 55792 | | | | 35600 |
| Nebitdag | 1019 | 1456 | 23008 | 44568 | | | | 27200 |
| Gazodjak | 1796 | 25963 | 4091 | 80448 | | | | 35300 |
| Kizilarbat | 721 | 1024 | 1616 | 3181 | 7200 | 7200 | 7200 | |
| Bairamaly | 9424 | 1345 | 2135 | 4211 | | | | |
| Bakharden | 5464 | 7624 | 1213 | 23680 | 156 | 210 | 3060 | |
| Archman | 5920 | 8248 | 1309 | 25696 | 198 | 2580 | 3000 | |
| Kaahka | 5728 | 718 | 1278 | 25024 | 198 | 2580 | 3000 | |

In such context where train is not competitive in any parameter which may impact on traffic (price, frequency, travel time, quality of service), its decline is not surprising. There are not really any commuter services which could have allowed the railway to keep part of its traffic share by providing social services. TDY calls « commuter » some local trains running twice a day mainly around Tchardjew.

The position of TDY will not improve until air services are not subsidised anymore, as is the case today, allowing pure competition between modes.

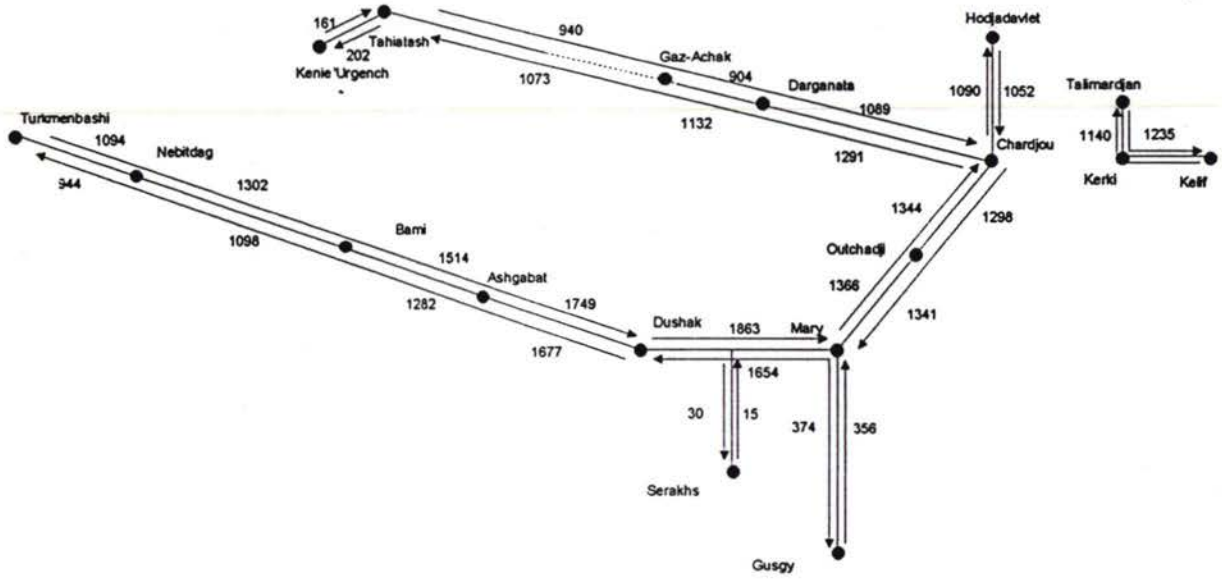
### 5.1.3.2 Freight traffic

Nevertheless freight traffic is improving encouragingly (nearly 8% in net tons). It is due to several factors:

- opening of the new line towards Iran through Serakhse (the traffic has gone from 0 up to 20000 ton-km cumulative, reaching nearly 7000 ton-km during the month of October,
- slight increase on some sections.

13 I.E. a 900 multiplying coefficient in less than 3 years. In 1997, a substantial decrease in passenger traffic was recorded.

Freight train number are shown in the next figure:




The number of trains by section is relatively constant (around 1200 by direction) except on some specific branch lines.

## Railway operating performance

Figures of railway performance show a slight improvement for the year 1997 as described in the following table :

| MONTH | TRAIN-KM | TOTAL HRS | RUNNING HRS | WAGON KM | | | NET TK | TKBR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | TOTAL (exc.eng.trc) | Loaded 000 | Empty 000 | FREIGHT 000 | FREIGHT | PASSENG. | TOTAL |
| JANUARY | 411 494 | 11 421 | 9 256 | 19 322 | 11 250 | 8 072 | 658 232 | 1 167 582 | 330 066 | 1 497 648 |
| FEBRUARY | 381 946 | 10 552 | 6 694 | 19 170 | 9 505 | 9 665 | 560 640 | 1 039 886 | 286 112 | 1 325 998 |
| MARCH | 398 385 | 11 298 | 9 249 | 18 857 | 10 369 | 8 488 | 586 854 | 1 066 070 | 308 241 | 1 374 311 |
| APRIL | 427 882 | 11 954 | 9 979 | 19 802 | 10 809 | 8 993 | 631 467 | 1 132 548 | 302 216 | 1 434 764 |
| MAY | 466 180 | 13 343 | 11 044 | 22 293 | 12 266 | 10 027 | 698 868 | 1 250 135 | 317 605 | 1 567 740 |
| JUNE | 441 898 | 12 860 | 10 435 | 18 565 | 10 183 | 8 382 | 638 892 | 1 160 543 | 287 186 | 1 447 729 |
| JULY | 422 348 | 12 448 | 10 356 | 19 753 | 10 714 | 9 039 | 618 212 | 1 111 200 | 284 562 | 1 395 762 |
| AUGUST | 440 487 | 12 811 | 10 325 | 21 727 | 11 571 | 10 156 | 626 228 | 1 152 639 | 294 507 | 1 447 146 |
| SEPTEMBER | 433 198 | 12 033 | 9 801 | 20 899 | 11 128 | 9 771 | 617 447 | 1 117 047 | 279 543 | 1 396 590 |
| OCTOBER | 442 628 | 12 265 | 9 943 | 21 097 | 11 558 | 9 539 | 650 752 | 1 171 458 | 263 349 | 1 434 807 |
| TOTAL (10 m.) | 4 266 446 | 120 985 | 97 082 | 201 485 | 109 353 | 92 132 | 6 287 592 | 11 369 108 | 2 953 387 | 14 322 495 |
| Average | 426 645 | 12 099 | 9 708 | 20 149 | 10 935 | 9 213 | 628 759 | 1 136 911 | 295 339 | 1 432 250 |
| Projection | 5 119 735 | 145 182 | 116 498 | 241 782 | 131 224 | 110 558 | 7 545 110 | 13 642 930 | 3 544 064 | 17 186 994 |
| 1996 figures | 4 834 281 | 141 420 | 110 741 | 239 955 | 128 027 | 111 928 | 7 003 525 | 13 057 943 | 4 484 490 | 17 898 306 |
| Increase | 5,91% | 2,66% | 5,20% | 0,76% | 2,50% | -1,22% | 7,73% | 4,48% | -20,97% | -3,97% |

Operational performance is also improving :

- the share of empty wagons is reducing,
- the total locomotive hours -including waiting times-(2,66%) is increasing less than running hours (5,20%) and train kilometres (5,91%). Therefore waiting times are decreasing by more than 6% from 30679 hours down to 28684 hours and/or running speed increasing. This is a significant performance bearing in mind that TDY is lacking spare parts for the maintenance of its lines.

## 5.2 Traffic analysis

### 5.2.1. Executive summary

Two scenarios for traffic forecasts have been considered : optimistic and conservative :

- The conservative scenario shows that tonnage volumes grow slightly up to the year 2002 and then remain steady. Average distance is reducing and therefore the impact on volumes in tons kilometres and revenues is stable and starts to reduce after the year 2002. Revenues in 2007 would be reduced by 10% in constant Manats. Passenger traffic would follow its present trend.
- The optimistic scenario shows high increase in terms of tonnage carried and slow but steady increase in volumes in tons kilometres and revenues. Revenue increase would be around 25%. Passenger traffic would maintain its position.

Passengers traffic forecasts are frankly pessimistic due to the competitive position. We assume that long distance traffic will disappear in the very short term.

### 5.2.2. Method

#### 5.2.2.1 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. Also, in most CIS countries, there is a great lack of traffic statistics. In Turkmenistan, as in most of the former USSR countries, no record is made of traffic patterns on origin/destination matrix. There is not even traffic data by commodity and by section.

The railways produced global data for the whole network which shows the breakdown by commodity in terms of tons.

The planning department within the commercial division was also contacted as another source in providing information on the possible changes which may arise on the network (such as increase of traffic to Iran, construction of pipeline, increase of the production of some goods) in order to integrate the strong impact of such evolution. Unfortunately there is a lack of traffic forecasts and market studies which would allow assessment of future needs for the railways.

Finally, Traceca Traffic Database Report has also been used.

The only information which was available within the railways concerned operation data by section :

- Volumes in tons, brut tons and ton-kilometres,
- Number of trains,
- Train-km, locomotive-km, hours.

Today this information is produced in Chardjew information centre and then sent to the Head Office on paper. Therefore there is a high level of duplicated work. The information is released on a monthly basis and introduced into computer and then delivered to the statistics department, which then processes the information without the use of computer. A manual yearly consolidation is produced.

This limitation in terms of data availability hinders the calculation of traffic forecasts on a macroeconomic basis. Conversely it does not help in determining a sensible transport plan.

Once the traffic per section and the GDP are known, it has been considered that the evolution of freight traffic is correlated to the production growth. Effectively, the traffic on Turkmenistan Railways consists of three main types of commodities which are strongly correlated to final consumption and GDP :

- oil products (refined oil)
- construction materials

- others

Two scenarios were then considered :

- an optimistic scenario, which take as a basis the middle GDP shown in TRACECA Traffic Database Report.
- a conservative scenario which took as a basis for traffic growth the low scenario of such study.

The expected evolution of GDP is shown underneath :

| Scenarios | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central | 1,00 | 1,02 | 1,04 | 1,06 | 1,08 | 1,10 | 1,14 | 1,18 | 1,22 | 1,27 | 1,31 | 1,36 |
| Low | 1,00 | 1,02 | 1,04 | 1,06 | 1,08 | 1,10 | 1,13 | 1,15 | 1,17 | 1,20 | 1,22 | 1,24 |

## 5.2.3 Traffic forecasts

### 5.2.3.1 Traffic forecasts by commodity

The traffic forecasts by commodity result from a combination between production growth and existing traffic by commodity. The tables underneath show the expected traffic both in tons and tons-km for each commodity.

Tonage by commodity (conservative scenario)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cement | 517 | 622 | 634 | 647 | 660 | 673 | 687 | 700 | 714 | 729 | 743 | 758 | 773 |
| Petroleum Products | 3 580 | 4 293 | 4 379 | 4 466 | 4 556 | 4 647 | 4 740 | 4 835 | 4 931 | 5 030 | 5 131 | 5 233 | 5 338 |
| Const. mat. | 5 462 | 4 424 | 4 512 | 4 603 | 4 695 | 4 789 | 4 884 | 4 982 | 5 082 | 5 183 | 5 287 | 5 393 | 5 501 |
| Chemicals | 374 | 813 | 829 | 846 | 863 | 880 | 898 | 916 | 934 | 953 | 972 | 991 | 1 011 |
| Cotton | 397 | 352 | 359 | 366 | 374 | 381 | 389 | 396 | 404 | 412 | 421 | 429 | 438 |
| Other | 11 834 | 5 399 | 5 507 | 5 617 | 5 729 | 5 844 | 5 961 | 6 080 | 6 202 | 6 326 | 6 452 | 6 581 | 6 713 |
| **Total** | **22 164** | **15 903** | **16 221** | **16 545** | **16 876** | **17 214** | **17 558** | **17 909** | **18 268** | **18 633** | **19 006** | **19 386** | **19 773** |

Tonnage by commodity (optimistic scenario)

| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cement | 51 | 622 | 634 | 647 | 660 | 673 | 687 | 71 | 736 | 76 | 788 | 81 | 844 |
| Petroleum Products | 3 580 | 4 293 | 4 379 | 4 466 | 4 556 | 4 647 | 4 740 | 4 906 | 5 077 | 5 255 | 5 439 | 5 629 | 5 826 |
| Const. mat. | 5 462 | 4 424 | 4 | 4 603 | 4 695 | 4 789 | 4 884 | 5 055 | 5 232 | 5 | 5 605 | 5 | 6 004 |
| Chemicals | 374 | 81 | 829 | 846 | 863 | 880 | 898 | 929 | 962 | 995 | 1 | 1 | 1 |
| Cotton | 397 | 352 | 359 | 366 | 374 | 38 | 389 | 402 | 41 | 43 | 446 | 462 | 478 |
| Other | 11 | 5 399 | 5 507 | 5 | 5 729 | 5 844 | 5 | 6 | 6 385 | 6 609 | 6 840 | 7 080 | 7 328 |
| Total | 22 164 | 15 903 | 16 221 | 16 545 | 16 876 | 17 214 | 17 558 | 18 173 | 18 809 | 19 467 | 20 148 | 20 854 | 21 584 |

TON KM by commodity (conservative scenario)

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cement | 216 | 220 | 225 | 229 | 234 | 238 | 243 | 248 | 253 | 258 | 263 | 268 |
| Petroleum Products | 2 578 | 2 630 | 2 683 | 2 736 | 2 791 | 2 847 | 2 904 | 2 962 | 3 021 | 3 082 | 3 143 | 3 206 |
| Const. mat. | 1 496 | 1 526 | 1 556 | 1 587 | 1 619 | 1 652 | 1 685 | 1 718 | 1 753 | 1 788 | 1 823 | 1 860 |
| Chemical | 119 | 121 | 124 | 126 | 129 | 131 | 134 | 136 | 139 | 142 | 145 | 148 |
| Cotton | 162 | 165 | 169 | 172 | 176 | 179 | 183 | 186 | 190 | 194 | 198 | 202 |
| Other | 2 432 | 2 480 | 2 530 | 2 581 | 2 632 | 2 685 | 2 739 | 2 793 | 2 849 | 2 906 | 2 964 | 3 024 |
| Total | 7 003 | 7 143 | 7 286 | 7 432 | 7 580 | 7 732 | 7 887 | 8 044 | 8 205 | 8 369 | 8 537 | 8 707 |

TON KM by commodity (optimistic scenario)

| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cement | 216 | 220 | 225 | 229 | 234 | 238 | 247 | 255 | 264 | 274 | 283 | 293 |
| Petroleum products | 2 578 | 2 630 | 2 683 | 2 736 | 2 791 | 2 847 | 2 946 | 3 050 | 3 156 | 3 267 | 3 381 | 3 500 |
| Const. mat. | 1 496 | 1 526 | 1 556 | 1 587 | 1 619 | 1 652 | 1 709 | 1 769 | 1 831 | 1 895 | 1 962 | 2 030 |
| Chemical | 119 | 121 | 124 | 126 | 129 | 131 | 136 | 141 | 145 | 151 | 156 | 161 |
| Cotton | 162 | 165 | 169 | 172 | 176 | 179 | 185 | 192 | 199 | 205 | 213 | 220 |
| Other | 2 432 | 2 480 | 2 530 | 2 581 | 2 632 | 2 685 | 2 779 | 2 876 | 2 977 | 3 081 | 3 189 | 3 300 |
| Total | 7 003 | 7 143 | 7 286 | 7 432 | 7 580 | 7 732 | 8 002 | 8 283 | 8 572 | 8 873 | 9 183 | 9 504 |

### 5.2.3.2 Determination of the number of trains

The number of trains is increasing according to GDP except for the new link to Iran which will go up to around 5 fully loaded trains on each direction within the next 3 years, demand being very high.

Therefore the number of trains running on each section is shown hereafter for both scenario :

Table n° : Train traffic by section - conservative scenario

| SECTION | | KM | N° TRAINS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Turkmenbashi | Niebet Dag | 161 | 1 094 | 1 116 | 1 138 | 1 161 | 1 184 | 1 208 | 1 250 | 1 294 | 1 339 | 1 386 | 1 435 | 1 485 |
| Niebet Dag | Turkmenbashi | 161 | 944 | 963 | 982 | 1 001 | 1 021 | 1 042 | 1 078 | 1 116 | 1 155 | 1 196 | 1 237 | 1 281 |
| Niebet Dag | Bami | 238 | 1 302 | 1 328 | 1 356 | 1 382 | 1 410 | 1 438 | 1 488 | 1 540 | 1 594 | 1 650 | 1 708 | 1 768 |
| Bami | Niebet Dag | 238 | 1 098 | 1 120 | 1 143 | 1 166 | 1 189 | 1 213 | 1 255 | 1 299 | 1 345 | 1 392 | 1 440 | 1 491 |
| Bami | Ashkabat | 166 | 1 514 | 1 545 | 1 576 | 1 607 | 1 639 | 1 672 | 1 731 | 1 791 | 1 854 | 1 919 | 1 986 | 2 056 |
| Ashkabat | Bami | 166 | 1 282 | 1 307 | 1 333 | 1 360 | 1 387 | 1 415 | 1 464 | 1 516 | 1 569 | 1 624 | 1 680 | 1 739 |
| Ashkabat | Dushak | 171 | 1 749 | 1 784 | 1 819 | 1 856 | 1 893 | 1 931 | 1 998 | 2 068 | 2 141 | 2 216 | 2 293 | 2 373 |
| Dushak | Ashkabat | 171 | 1 677 | 1 710 | 1 745 | 1 780 | 1 815 | 1 851 | 1 916 | 1 983 | 2 053 | 2 125 | 2 199 | 2 276 |
| Dushak | Mary | 172 | 1 883 | 1 900 | 1 936 | 1 977 | 2 016 | 2 056 | 2 128 | 2 203 | 2 280 | 2 360 | 2 442 | 2 528 |
| Mary | Dushak | 172 | 1 654 | 1 687 | 1 720 | 1 755 | 1 790 | 1 826 | 1 890 | 1 956 | 2 024 | 2 095 | 2 168 | 2 244 |
| Mary | Outchadji | 110 | 1 366 | 1 393 | 1 421 | 1 450 | 1 479 | 1 508 | 1 561 | 1 616 | 1 672 | 1 731 | 1 791 | 1 854 |
| Outchadji | Mary | 110 | 1 341 | 1 368 | 1 395 | 1 423 | 1 451 | 1 480 | 1 532 | 1 586 | 1 641 | 1 699 | 1 758 | 1 820 |
| Outchadji | Tchardjoou | 134 | 1 344 | 1 371 | 1 398 | 1 426 | 1 455 | 1 484 | 1 536 | 1 589 | 1 645 | 1 702 | 1 762 | 1 824 |
| Tchardjoou | Outchadji | 134 | 1 298 | 1 324 | 1 350 | 1 377 | 1 405 | 1 433 | 1 483 | 1 535 | 1 588 | 1 644 | 1 701 | 1 761 |
| Tchardjoou | Darganata | 213 | 1 291 | 1 317 | 1 343 | 1 370 | 1 397 | 1 425 | 1 475 | 1 527 | 1 580 | 1 636 | 1 693 | 1 752 |
| Darganata | Tchardjoou | 213 | 1 089 | 1 111 | 1 133 | 1 156 | 1 179 | 1 203 | 1 245 | 1 288 | 1 334 | 1 380 | 1 429 | 1 479 |
| Darganata | Gazatchak | 109 | 1 132 | 1 154 | 1 177 | 1 201 | 1 225 | 1 249 | 1 293 | 1 338 | 1 385 | 1 434 | 1 484 | 1 536 |
| Gazatchak | Darganata | 109 | 904 | 922 | 941 | 960 | 979 | 998 | 1 033 | 1 070 | 1 107 | 1 146 | 1 186 | 1 227 |
| St 499 | Takhiatash | 71 | 1 073 | 1 094 | 1 116 | 1 139 | 1 161 | 1 185 | 1 226 | 1 269 | 1 313 | 1 359 | 1 407 | 1 456 |
| Takhiatash | St 499 | 71 | 940 | 959 | 978 | 997 | 1 017 | 1 038 | 1 074 | 1 112 | 1 151 | 1 191 | 1 232 | 1 276 |
| Takhiatash | Kenie Urgench | 40 | 202 | 206 | 210 | 214 | 219 | 223 | 231 | 239 | 247 | 256 | 265 | 274 |
| Kenie Urgench | Takhiatash | 40 | 161 | 165 | 168 | 171 | 175 | 178 | 184 | 191 | 197 | 204 | 212 | 219 |
| Tchardjou | Hodjadavlet | 30 | 1 090 | 1 112 | 1 134 | 1 157 | 1 180 | 1 203 | 1 245 | 1 289 | 1 334 | 1 381 | 1 429 | 1 479 |
| Hodjadavlet | Tchardjoou | 30 | 1 052 | 1 073 | 1 094 | 1 116 | 1 138 | 1 161 | 1 202 | 1 244 | 1 287 | 1 332 | 1 379 | 1 427 |
| St 161 | Talmardjan | 184 | 1 140 | 1 163 | 1 186 | 1 210 | 1 234 | 1 259 | 1 303 | 1 348 | 1 396 | 1 445 | 1 495 | 1 547 |
| Talmardjan | St 161 | 184 | 1 235 | 1 260 | 1 285 | 1 311 | 1 337 | 1 364 | 1 412 | 1 461 | 1 512 | 1 565 | 1 620 | 1 677 |
| Zarpchi | Kubadag | 24 | 241 | 246 | 251 | 256 | 261 | 266 | 275 | 285 | 295 | 305 | 316 | 327 |
| Kubadag | Zarpchi | 24 | 199 | 203 | 207 | 211 | 215 | 220 | 227 | 235 | 243 | 252 | 261 | 270 |
| Kushka | Mary | 315 | 356 | 364 | 371 | 379 | 388 | 394 | 407 | 422 | 436 | 452 | 467 | 484 |
| Mary | Kushka | 315 | 374 | 381 | 389 | 397 | 405 | 413 | 427 | 442 | 458 | 474 | 490 | 508 |
| Serakhse | Parahat | 122 | 15 | 300 | 600 | 1 460 | 1 580 | 1 612 | 1 668 | 1 727 | 1 787 | 1 850 | 1 915 | 1 982 |
| Parahat | Serakhse | 122 | 30 | 300 | 600 | 1 460 | 1 580 | 1 612 | 1 668 | 1 727 | 1 787 | 1 850 | 1 915 | 1 982 |
| | | | | | | | | | | | | | | |
| TOTAL | | | 32 049 | 33 244 | 34 497 | 36 883 | 37 803 | 38 559 | 39 909 | 41 305 | 42 751 | 44 247 | 45 796 | 47 399 |

Table n° : Train traffic by section - optimistic scenario

| SECTION | | KM | N° TRAINS | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Turkmenbashi | Niebet Dag | 181 | 1 094 | 1 132 | 1 172 | 1 213 | 1 256 | 1 299 | 1 345 | 1 392 | 1 441 | 1 491 | 1 543 | 1 597 |
| Niebet Dag | Turkmenbashi | 181 | 944 | 977 | 1 011 | 1 046 | 1 083 | 1 121 | 1 160 | 1 201 | 1 243 | 1 286 | 1 331 | 1 378 |
| Niebet Dag | Bami | 238 | 1 302 | 1 348 | 1 395 | 1 444 | 1 494 | 1 547 | 1 601 | 1 657 | 1 715 | 1 775 | 1 837 | 1 901 |
| Bami | Niebet Dag | 238 | 1 096 | 1 137 | 1 177 | 1 218 | 1 261 | 1 305 | 1 350 | 1 398 | 1 447 | 1 497 | 1 550 | 1 604 |
| Bami | Ashkabat | 166 | 1 514 | 1 567 | 1 622 | 1 679 | 1 738 | 1 799 | 1 862 | 1 927 | 1 994 | 2 064 | 2 136 | 2 211 |
| Ashkabat | Bami | 166 | 1 282 | 1 326 | 1 373 | 1 421 | 1 471 | 1 522 | 1 575 | 1 630 | 1 688 | 1 747 | 1 808 | 1 871 |
| Ashkabat | Dushak | 171 | 1 748 | 1 810 | 1 873 | 1 938 | 2 007 | 2 077 | 2 150 | 2 225 | 2 303 | 2 383 | 2 467 | 2 553 |
| Dushak | Ashkabat | 171 | 1 677 | 1 736 | 1 796 | 1 859 | 1 924 | 1 992 | 2 061 | 2 134 | 2 208 | 2 285 | 2 365 | 2 448 |
| Dushak | Mary | 172 | 1 803 | 1 928 | 1 995 | 2 065 | 2 137 | 2 212 | 2 290 | 2 370 | 2 453 | 2 538 | 2 627 | 2 719 |
| Mary | Dushak | 172 | 1 654 | 1 711 | 1 771 | 1 833 | 1 897 | 1 964 | 2 033 | 2 104 | 2 177 | 2 254 | 2 332 | 2 414 |
| Mary | Outchadji | 110 | 1 385 | 1 414 | 1 463 | 1 515 | 1 568 | 1 623 | 1 679 | 1 738 | 1 799 | 1 862 | 1 927 | 1 994 |
| Outchadji | Mary | 110 | 1 341 | 1 388 | 1 436 | 1 487 | 1 539 | 1 592 | 1 648 | 1 706 | 1 766 | 1 827 | 1 891 | 1 958 |
| Outchadji | Tchardjoou | 134 | 1 344 | 1 391 | 1 439 | 1 490 | 1 542 | 1 596 | 1 652 | 1 710 | 1 769 | 1 831 | 1 895 | 1 962 |
| Tchardjoou | Outchadji | 134 | 1 298 | 1 343 | 1 390 | 1 439 | 1 489 | 1 541 | 1 595 | 1 651 | 1 709 | 1 768 | 1 830 | 1 894 |
| Tchardjoou | Darganata | 213 | 1 291 | 1 336 | 1 383 | 1 431 | 1 482 | 1 533 | 1 587 | 1 643 | 1 700 | 1 760 | 1 821 | 1 885 |
| Darganata | Tchardjoou | 213 | 1 089 | 1 128 | 1 167 | 1 208 | 1 250 | 1 294 | 1 339 | 1 386 | 1 435 | 1 485 | 1 537 | 1 590 |
| Darganata | Gazatchak | 109 | 1 132 | 1 171 | 1 212 | 1 255 | 1 298 | 1 344 | 1 391 | 1 440 | 1 490 | 1 542 | 1 596 | 1 652 |
| Gazatchak | Darganata | 109 | 904 | 936 | 969 | 1 003 | 1 038 | 1 074 | 1 112 | 1 150 | 1 191 | 1 232 | 1 276 | 1 320 |
| St 499 | Takhiatash | 71 | 1 073 | 1 110 | 1 148 | 1 190 | 1 234 | 1 274 | 1 319 | 1 365 | 1 413 | 1 462 | 1 513 | 1 566 |
| Takhiatash | St 499 | 71 | 940 | 973 | 1 007 | 1 042 | 1 079 | 1 116 | 1 155 | 1 196 | 1 238 | 1 281 | 1 326 | 1 372 |
| Takhiatash | Kerse Urgench | 40 | 202 | 209 | 216 | 224 | 232 | 240 | 248 | 257 | 266 | 275 | 285 | 295 |
| Kerse Urgench | Takhiatash | 40 | 161 | 167 | 173 | 179 | 185 | 192 | 198 | 205 | 212 | 220 | 228 | 235 |
| Tchardjoou | Hodjadavlet | 30 | 1 090 | 1 128 | 1 168 | 1 208 | 1 251 | 1 294 | 1 340 | 1 387 | 1 435 | 1 485 | 1 537 | 1 591 |
| Hodjadavlet | Tchardjoou | 30 | 1 052 | 1 088 | 1 126 | 1 166 | 1 207 | 1 249 | 1 293 | 1 338 | 1 385 | 1 433 | 1 483 | 1 535 |
| St 181 | Talimardjan | 184 | 1 140 | 1 180 | 1 221 | 1 264 | 1 308 | 1 354 | 1 402 | 1 451 | 1 501 | 1 554 | 1 608 | 1 665 |
| Talimardjan | St 181 | 184 | 1 235 | 1 279 | 1 323 | 1 370 | 1 418 | 1 467 | 1 519 | 1 572 | 1 627 | 1 684 | 1 743 | 1 804 |
| Zarpchi | Kusadag | 24 | 241 | 249 | 258 | 267 | 276 | 285 | 296 | 306 | 317 | 328 | 340 | 352 |
| Kucadag | Zarpchi | 24 | 199 | 206 | 213 | 221 | 228 | 236 | 245 | 253 | 262 | 271 | 281 | 290 |
| Kusadag | Mary | 315 | 354 | 366 | 382 | 395 | 409 | 423 | 438 | 454 | 469 | 486 | 503 | 520 |
| Mary | Kushka | 315 | 374 | 387 | 401 | 415 | 429 | 444 | 460 | 476 | 492 | 510 | 528 | 546 |
| Serachse | Parahat | 122 | 15 | 300 | 600 | 1 460 | 1 675 | 1 734 | 1 795 | 1 858 | 1 923 | 1 990 | 2 059 | 2 132 |
| Parahat | Serakhse | 122 | 35 | 300 | 600 | 1 460 | 1 675 | 1 734 | 1 795 | 1 858 | 1 923 | 1 990 | 2 059 | 2 132 |
| | | | | | | | | | | | | | | |
| TOTAL | | | 32 054 | 33 724 | 35 484 | 38 403 | 40 076 | 41 479 | 42 931 | 44 433 | 45 988 | 47 598 | 49 264 | 50 988 |

### 5.2.3.3 Passenger traffic

Passenger traffic has reduced drastically in the past years. In the optimistic scenario it is assumed that in order to maintain its share, the railways will improve existing services (inc. refurbishing of coaches, implementation of faster services between major cities such as Turkmenbashi, Ashgabat, Mary and Tchardjew). It has also been considered that the Air Transport will not receive subsidies anymore for its national services.

Passenger traffic forecasts (optimistic scenario)

| Passengers (in 000's) | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commuter | 3 340 | 4 379 | 5 854 | 6 658 | 7 478 | 8 314 | 9 807 | 11 353 | 12 952 | 14 607 | 16 321 | 18 094 |
| Interurban | 3 399 | 758 | 500 | 365 | 365 | 372 | 385 | 399 | 413 | 427 | 442 | 458 |
| International traffic | 1 035 | 564 | 464 | 464 | 464 | 473 | 490 | 507 | 525 | 543 | 562 | 582 |
| **TOTAL** | **7 774** | **6 211** | **6 818** | **7 487** | **8 307** | **9 160** | **10 682** | **12 258** | **13 889** | **15 578** | **17 325** | **19 133** |

| Pass.-km (in millions) | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commuter | 326 | 387 | 517 | 588 | 661 | 735 | 867 | 1 003 | 1 144 | 1 291 | 1 442 | 1 599 |
| Interurban | 1 382 | 296 | 195 | 143 | 143 | 145 | 150 | 156 | 161 | 167 | 173 | 179 |
| International traffic | 395 | 122 | 100 | 100 | 100 | 102 | 106 | 109 | 113 | 117 | 121 | 125 |
| **TOTAL** | **2 104** | **954** | **813** | **831** | **903** | **982** | **1 123** | **1 268** | **1 419** | **1 575** | **1 736** | **1 903** |

In the conservative scenario there will not be long distance traffic; the only part remaining will be commuter and international traffic for Uzbek trains in the north eastern part of the country. Nevertheless, this international traffic may reduce very considerably when the Uzbek Railways build their link further north which allows avoidance of Turkmenistan territory.

Passenger traffic forecasts (conservative scenario)

| Passengers (in 000's) | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commuter | 3 340 | 4 379 | 5 854 | 6 658 | 7 478 | 8 314 | 9 167 | 10 038 | 10 925 | 11 831 | 12 754 | 13 696 |
| Interurban | 3 399 | 758 | 500 | 365 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| International traffic | 1 035 | 564 | 464 | 464 | 464 | 473 | 483 | 492 | 502 | 512 | 522 | 533 |
| TOTAL | 7 774 | 6 211 | 6 818 | 7 487 | 7 942 | 8 788 | 9 650 | 10 530 | 11 428 | 12 343 | 13 277 | 14 229 |

| Pass.-km (in millions) | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Commuter | 326 | 387 | 517 | 588 | 661 | 735 | 810 | 887 | 965 | 1 045 | 1 127 | 1 210 |
| Interurban | 1 382 | 296 | 195 | 143 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| International traffic | 395 | 122 | 100 | 100 | 100 | 102 | 104 | 106 | 108 | 110 | 113 | 115 |
| TOTAL | 2 104 | 954 | 813 | 831 | 761 | 837 | 914 | 993 | 1 074 | 1 156 | 1 240 | 1 325 |

On both scenarios there will be a strong need for commuter services taking into account the existing trends (which shows nearly a 18% increase when GDP growth was only 2%).

### 5.2.4 Analysis of international flows

In the long term, the construction of several lines both in Turkmenistan and Uzbekistan may impact very significantly on international traffic, in particular for the line which runs along the border between Turkmenistan and Uzbekistan and the link between Karshi and the southern area of Uzbekistan.

The link between Iran and Turkmenistan and the development of the TRACECA corridor should compensate for such reduction.

# 6. Financial Review of Turkmenistan Railways (TDY)

## 6.1. Introduction

### 6.1.1 Data Collection

During the project start-up phase the consultants met with the Deputy Head of Finance of TDY and explained the purpose of the project and the need to obtain basic financial information in order to assess the current financial situation of TDY and to prepare financial projections. The three main categories of information requested in the initial stages were as follows :

The TDY Income statement showing details of revenue, expenditure, profitability, taxes, and profit distributions

Details of TDY expenditures analysed to railway department level as a basis for determining future costs based on changes in activity levels and staffing levels

The TDY Balance Sheet showing the current financial position of the railway.

Turkmenistan Railways kindly provided summary details of income and expenditure in a format which enables a general assessment of profitability. The consultants were, however, informed that detailed balance sheet information could not be provided as this was confidential information that could not be released without very high level authorisation. Summarised balance sheet data showing the major categories of assets and liabilities was given to the consultants but more detailed analysis, particularly of the account receivables and accounts payable balances, was not provided.

The analysis contained in this report is therefore limited by the quantity and quality of the data provided. The Deputy Head of Finance of TDY made herself available to the consultants on a regular basis and provided many useful insights into the financial situation of the railway. Where possible the information provided during these meetings has been included in this report but the consultants have tried to avoid placing undue emphasis on anecdotal accounts.

### 6.1.2 International Accounting Standards

The accounting data of TDY is not prepared according to international accounting standards and the financial information presented to the consultants has not been subjected to the type of independent audit that is customary in Western Europe. As a result of this it cannot be categorically stated that the financial results of TDY, as presented to the consultants, represent a "true and fair" view of the profitability or current financial position of TDY.

TDY staff have attended training seminars in Tashkent aimed at introducing them to international accounting standards and procedures. The current TDY accounting procedures are a carry over from the former Soviet Union. It is understood that there are no plans to introduce international accounting standards in Turkmenistan Railways at present.

The proposals that are being made by the management information systems expert include the development of a Financial Management System as one of the high priority computer systems development projects. The introduction of such a system will greatly improve the quality and quantity of financial information available to TDY management and other governmental authorities. In addition to this an integrated Financial Management System will improve the financial control in TDY and assist the company in managing its scare cash resources.

It would seem appropriate to plan for the introduction of international accounting standards and procedures to coincide with the development and implementation of the new financial management system. Due consideration will need to be given to the internal financial and fiscal reporting requirements of Turkmenistan which may prevent a straight transfer to international accounting standards.

### 6.1.3 Hard Currency Fund

Since January of 1997 the proceeds of hard currency transactions have been accumulated in a special State Fund for Transport Development in Turkmenistan. The fund applies to the entire transport sector, not just to TDY. The proceeds from hard currency railway activities such as transit traffic are accounted for through this fund. The Deputy Head of Finance for TDY informed the consultants that the balance due to TDY for the first nine months of 1997 was approximately $16 million dollars.

The debts owed to TDY by Uzbekistan Railways for example will be used by the state to barter for imports from Uzbekistan. These goods are disposed of in Turkmenistan often at substantially lower prices than they were acquired for. The Deputy Head of Finance indicated that one such recent transaction involved the disposal of $8 million dollars worth of fertilisers acquired from Uzbekistan on the commodities exchange for $4 million dollars. The goods were sold to the agriculture sector which receives significant state support. Barter transaction costs can therefore be regarded as very high in Turkmenistan.

The consultants were also verbally informed that the Ministry of Finance and Economics has agreed that hard currency revenue of TDY need only be included in the accounts when it is actually received in cash by the railway by way of disbursements from the hard currency fund. The benefit of this to TDY is that it does not have to pay tax on revenue earned but not received from the fund. The Railway will normally receive Manats (at the official government exchange rate) in return for its hard currency revenue; however it can also apply for hard currency as required. This practice has the effect of understating the revenue earned by TDY and therefore understating its profitability. In addition debts owed to TDY are excluded from the accounts receivable amount stated in the balance sheet which makes TDY's balance sheet appear weaker than it should be.

The operation of the Hard Currency Fund makes it difficult to make any definitive statements regarding the financial position of TDY. The amounts ultimately received from the hard currency fund could be substantially lower than the full amount of the original debt due to the impact of barter transaction costs and the conversion of hard currency to manats at an official government exchange rate.

### 6.1.4 Adjustments to the Accounts

In order to present the financial results in an internationally acceptable format it is necessary to make a number of adjustments to the officially published data. The main adjustments that are required are in the following areas :

- reclassification of costs that are currently reported as profit distributions. These relate to payments of staff bonuses and costs associated with maintaining "social infrastructure" that continue to be funded by TDY . In common with other railways in the former Soviet Union TDY provided staff with an extensive range of housing, medical, and recreational services that are more properly the responsibility of other municipal or national authorities. TDY has already begun the process of shedding much of its responsibilities in these areas and has received Presidential approval for its actions. In the interim period TDY has informed the consultants that they are reducing the amount of expenditure in the social services area to provide only essential facilities.
- adjustment of the depreciation charge to reflect the need to provide for the replacement of assets at current prices. In determining the size of the replacement costs depreciation provision it is essential that a realistic view be taken of the quantity of assets that will be needed by TDY to continue its operations in the future.
- bad debts write-off and provision for doubtful debts. TDY is constrained by current regulations which prohibit the writing off of debts and the consultants have not been able to obtain estimates of the current bad debt position.

The remainder of this report contains

- a review of the financial performance of TDY during 1996 and an indication of the current trends based on the financial data for the first half of 1997,
- a review of the financial position of TDY as determined by its balance sheets for 1996 and the first half of 1997

- the recent changes in the working capital requirements of the company and its immediate liquidity position

## 6.2 Financial Performance of TDY

### 6.2.1 Classification of Activities

TDY provided the consultants with summary income statement data and it classifies it activities as

- **Transport related activity**, which covers the revenue and costs associated with the actual transportation of freight and passenger traffic.
- **Auxiliary activity**, which includes the revenues and costs associated with industrial production carried out by the railway for its own use or for external parties.
- **Other sales**, which covers the revenue and costs associated with the provision of non-transport services. It also includes exchanges losses such as the very large loss incurred in 1996 when TDY repaid debts owed to Russian that were in dispute for many years.
-

### 6.2.2 Profitability

The data contained in the table below was provided by TDY's statistics department. Current indications are that freight tonnage is growing slightly in 1997; however the passenger kilometres data indicates a dramatic decline in passenger traffic.

**TDY Statistical Data**

| Statistics | Actual 1995 | Actual 1996 | Actual 6 months 1997 |
|---|---|---|---|
| Freight Tonnes (mls) | 22.2 | 15.9 | 9.0 |
| Freight Tonne Kms (mls) | 9,147 | 7,003 | 3,773 |
| Passenger Kms (mls) | 1,876 | 2,103 | 477 |
| Average Number of Employees in Transportation | 19,651 | 19,230 | 19,035 |

## Transportation Revenue : Freight and Passenger Services

It should be noted that the freight revenue for 1997 is understated as it does not include revenue earned in foreign currency. This revenue is accounted for through the State Hard Currency Fund for Transport Development and TDY has opted0 not to report this revenue in its accounts until it receives the money in its account. The consultants were informed that at the end of September the amount due to TDY from the fund stood at $16 million dollars. It is likely that TDY will receive its funds partly in cash and partly in barter goods.

Freight revenue for 1996 was 137,854 million manats, an average tariff per tonne kilometre of 8,670 manats. Due to the impact of inflation in 1997 reported revenue for the first six months was 100,042 million manats ( excluding foreign currency revenue). If we assume that foreign currency revenue for the first six months was approximately $10 million dollars or 40,000 million manats at the official exchange rate then total revenue would increase to 140,042 million manats. This would give an average revenue per tonne of 15,560 manats or an increase of almost 80% in the average tariff.

Passenger revenue in 1996 was 7,544 million manats or 3.6 manats per passenger kilometre. Again largely due to inflationary adjustments in 1997 revenue for the first six months was 10,218 million manats or 21.4 manats per passenger kilometre representing an increase of almost 600%. The indications are that passenger traffic has declined significantly due to rising tariff levels.

Cash shortages in TDY, largely due to the operation of the hard currency fund and the high level of barter transaction, has forced TDY to resort to increasing its tariffs in order to generate local currency income. The consultants were verbally informed that approximately 40% of the revenue of TDY is in the form of barter goods.

## Transportation Expenditure : Freight and Passenger Service

The impact of inflation makes direct comparison between accounting periods very difficult. Total expenditure during 1996 was 81,154 million manats but during the first six months of 1997 TDY expenditure on transportation services was 75,622 million or 93% of the total manats figure for 1996.

The employment data for the first quarter of 1997 shows that the number of staff now classified as being directly involved in the provision of transport services has decreased slightly from an average of 19,230 in 1996 to an average of 19,035 during the first six months of 1997.

**Turkmenistan Railways**
**Average Staff Employed in Transportation Activities**

| Service | Number of Staff 1996 | Number of Staff 1997 (6 Months) |
|---|---|---|
| Passenger Service | 2,193 | 2,144 |
| Freight & Commercial | 2,803 | 2,609 |
| Locomotive | 3,114 | 3,149 |
| Wagons | 1,748 | 1,764 |
| Track | 4,630 | 4,743 |
| Civil | 935 | 822 |
| Signalling & Telecoms | 1,654 | 1,657 |
| Electrical Supply | 443 | 452 |
| Railway Sections | 1,710 | 1,695 |
| Total | 19,230 | 19,035 |

Salary and Social Insurance costs for 1996 were 17,241 million manats or 21% of total transportation expenditure. This figure does not include the payment of bonuses to staff which are treated as a distribution of profits in the TDY accounts. In the first six months of 1997 staff costs were 18,036 million manats which was higher than the full year cost for 1996. The Locomotive and Track departments accounted for almost 50% of the total salary costs of the railway.

Expenditure on Materials for 1996 was 10,044 million manats or 12% of total expenditures for transportation. By the end of the first six months of 1997 12,657 million manats had been spent and it represented almost 17% of total transport expenditure. The Locomotive department accounted for 70% of the total materials expenditures. Repair fund expenditures are separately reported.

Traction fuel costs for 1996 were 9,661 million manats or 12% of total costs. During the first six months of 1997 these costs were 9,406 million manats.

Depreciation costs of 11,875 million manats for 1996 are based on the revalued costs of the fixed assets. The revaluation of fixed assets occurred on the 1st April 1996 and the consultants were informed that no revaluation has taken place since that time. The reported depreciation for the first six months of 1997 was 11,931 million manats which in the absence of further revaluation indicates the acquisition of new assets, as the charge for six months is higher than the charge for the whole of 1996. Despite the revaluation of 1996, TDY's assets, are undervalued for depreciation purposes and the depreciation charge needs to be adjusted to reflect current replacement cost values for essential assets. This is dealt with later in this report.

TDY continues to provide for repair work through a repair fund as required by the accounting system of the former Soviet Union. The amount provided in the accounts for 1996 was 12,068 million manats or 15% of total transport expenditures. The repair fund provision for the first six months of 1997 was 11,366 million manats which again represented 15% of total expenditure for the period.

In 1996 TDY spent 18,358 million manats on other miscellaneous items. It is significant to note that despite inflation these expenditures fell to 9,597 million manats for the first six months of 1997 which indicates that there is a significant element of discretion in this area.

## Transport Net Result : Freight and Passenger Services

The net result for transport activities for 1996 was a reported profit of 64,244 million manats or a 44% margin. The reported profit for the first six months of 1997 was 34,638 million manats or a margin of 31%. It must be remembered that 1997 excludes the foreign currency revenue held in the hard currency fund for transport development. If, after allowing for barter transaction costs of approximately 40% , we assume that TDY could realise 24,000 million manats of the 40,000 million manats referred to above then the adjusted profit would be 58,638 million manats or a margin of 39%.

## Auxiliary Activity Revenue

The reported revenue from auxiliary activities for 1996 was 42,867 million manats and this increased to 43,903 million manats for the first six months of 1997. The consultants were informed by TDY finance staff that auxiliary activity revenue includes inter unit charges, for example the revenue earned by the Locomotive unit from supplying services to the Track department for hauling ballast trains. Because each of the 53 units that make up TDY is regarded as an independent entity for taxation accounting purposes then these revenues are not netted off in a consolidation. By international accounting standards it appears likely that the auxiliary revenue is overstated although it has not been possible to determine what the auxiliary revenue earned from external organisations figure is.

## Auxiliary Activity Expenditures

Total expenditure on auxiliary activities for 1996 was 34,147 million manats and

for the first six months of 1997 it was 38,161 million manats.

## Auxiliary Activity Net Result

TDY reported a net profit of 8,720 million manats for auxiliary activities which represented a margin of 20%. As TDY includes inter railway unit charges in its reported figures for auxiliary activities the actual profit margin from external trading with non railway customers cannot be estimated.

The reported net profit figure for the first six months of 1997 was 5,742 million manats or a gross margin of 13%.

## Other Income & Expenditures

Other income for 1996 amounted to 1,241 million manats and this increased to 2,931 million manats for the first six months of 1997.

The reported other expenditure for 1996 was insignificant ( 1 million manats); however TDY did report a foreign currency loss of 101,188 million for 1996. The foreign currency loss related to disputed debts with Russian railways which had been on TDY's books for many years. A decision was taken to pay the debts and suffer the exchange loss in 1996 as a further depreciation in the value of the manat was feared, which would have resulted in an even larger manat loss being reported.

Other income for 1997 amounted to 2,931 million manats which was an increase of 236% versus the full year income for 1996.

Other expenditures reported for the first six months of 1997 was 2,394 million manats.

## Adjustments required to TDY reported net result

The TDY income statements has been adjusted to take account of three categories of expenditure which are treated as distributions from profits.

- Expenditure of Social Needs

This expenditure relates to the maintenance and operation of social services for railway employees. TDY hopes to transfer the responsibility for the maintenance and operation of the social services outside the railway to other government ministries or to municipal authorities.

Expenditure on these services amounted to 1,351 million manats in 1996 and to 6,500 million manats in the first six months of 1997. The consultants were informed that before TDY hands over railway housing to municipal authority control they will be required to carry out essential repairs and maintenance.

- Expenditure on Consumption Fund

Profit distributions which are classified by TDY as payments to the consumption fund mainly relate to the payment of staff bonuses and other staff related expenditures and these should also be treated as operating expenses.

Expenditure in this category in 1996 amounted to 5,940 million manats and in the first six months of 1997 it amounted to 7,963 million manats.

- Expenditure on the Development Fund

Expenditure in this category in 1996 amounted to 786 million manats and in the first six months of 1997 it amounted to 3,616 million manats.

## Taxation

Each of the railway units is treated as separate entity for tax purposes and is assessed separately for tax purposes. This accounts for the fact that TDY paid profit tax in 1996 despite having incurred a very significant foreign currency exchange loss as a result of the settlement for the outstanding debt to Russian Railways. The foreign exchange was reported as part of the costs of the central administration function and could not be offset against the profits of other railway units.

TDY pays profit tax at the rate of 25% and profit tax at the rate of 1% of the cost of property. It must also pay a tax to support the development of the agricultural sector of Turkmenistan.

TDY was also taxed for exceeding the salary norms in 1996 and the first six months of 1997.

## Net Result after Tax

In 1996 TDY had a calculated after tax loss of 44,451 million manats entirely due to the foreign exchange loss referred to above. In the first six months of 1997 it had a calculated net profit of 6,000 million manats which it used to reduce its accumulated losses of the previous year.

Again it must be mentioned that the figure for 1997 excludes the benefit of the foreign currency revenue that is held in the hard currency fund for transport development. It has been assumed above that if TDY realised 24,000 million manats of this as revenue it would significantly improve its financial results. If it paid tax at the rate of 25% on the assumed 24,000 million manats it would still have retained a further 18,000 million manats in after tax income. Adding this 18,000 million manats to the 6,000 million manats surplus for the first six months of 1997 would have resulted in a total after tax retained profit of 24,000 million manats.

## Replacement Cost Depreciation

TDY's depreciation in its accounts is based on the asset values contained in its books following the revaluation of April 1996. The depreciation charge is clearly insufficient to provide for the replacement of the core assets. The table below contains a calculation of the additional depreciation charge that would be required based on current replacement costs.

The replacement cost figure has been based on the required number of diesel locomotive to operate services rather that the full existing fleet. Similarly the replacement cost of wagons has been calculated based on the available wagons in TDY's wagon fleet. A provision has been included for the replacement cost depreciation of mainline track.

*TDY Depreciation : Replacement Cost Calculation - for 1996 Accounts*

| *Asset Category* | Quantity Units | Life Span | Replacement Cost Millions US$ | Asset Value Millions US$ | Replacement Depreciation Millions US$ |
|---|---|---|---|---|---|
| ***Locomotives*** | | | | | |
| *Diesel Mainline requirement* | 130 | 25 | 3.000 | 390 | 15.6 |
| *Diesel Shunters requirement* | 55 | 25 | 1.000 | 55 | 2.2 |
| ***Oil tankers owned*** | 1,608 | 33 | 0.022 | 35 | 1.1 |
| ***Freight Wagons owned*** | 4,612 | 33 | 0.030 | 138 | 4.2 |
| ***Passenger Coaches owned*** | 300 | 25 | 0.700 | 210 | 8.4 |
| ***Main Track (Kilometres)*** | 2,349 | 40 | 0.300 | 705 | 17.6 |
| ***Total Depreciation - US$ Millons*** | | | | | 49.1 |
| ***Total Depreciation - Manats (Millions)*** | | | | | 245,411 |
| ***Depreciation included in 1996 Accounts (Coaches, Wagons, Locomotives, Track Service)*** | | | | | 10,885 |
| ***Minimum additional depreciation*** | | | | | 234,526 |

**Adjusted Net Result of TDY**

The impact of applying replacement cost depreciation is to generate a loss for 1996 of 278,977 million manats ( approx $55 million dollars). A loss of 99,332 million manats would be generated in the first six months of 1997 if replacement cost principles were applied. However if we allow a notional add after tax profit of 18,000 million manats in respect of the foreign currency revenue not included in the accounts this would be reduced to a loss of 81,332 million manats ( approx. $16.)

## 6.3 Financial Position of TDY

The consultants were not provided with access to the official TDY balance sheet . This document is deemed to be confidential and the consultants were told that very high level authorisation would be required before it could be released. TDY's finance department provided summary balance sheet details which are presented in this report. The limited data provided restricted the amount of analysis that could be performed.

The data presented in the summary TDY balance sheet provided to the consultants has not been subjected to an independent financial audit to verify its accuracy. This factor must be borne in mind when making any assessment of the financial position of TDY.

**Fixed Assets**

There was no significant movement in the reported value of fixed assets between the end of 1996 and the end of the first half of 1997. Capital work in progress increased between the end of 1996 and the end of the first half of 1997. It must be remembered that TDY is in the process of constructing new railway lines, entirely from its own resources, and this will have an impact on the value of capital work in progress reported in the balance sheet.

**Current Assets**

The current assets value declined significantly between 1996 and 1997. TDY's cash reserves were significantly reduced and its reported accounts receivable balance also declined. It is understood that TDY has not included debts due in foreign currency in the amount of accounts receivable as it has not taken the associated revenue into its reported income statement.

The value of production reserves and inventory remained stable in manat terms between 1996 and 1997.

**Current Liabilities**

Current Liabilities remained stable between 1996 and 1997. The consultants were not provided with a breakdown of the creditors although it is understood that the construction of the new railway lines is resulting in a build up of debts to Russia. Given the fact that TDY is required to construct these new lines from its own resources it is conceivable that this is a significant factor influencing the size of the current liabilities balance.

**Total Capital and Reserves**

The most significant amount in the capital and reserves section of the balance sheet is the size of the fixed asset revaluation reserve. Apart from the accumulated losses there are no other significant items in this area.

**Note on Long Term Liabilities**

TDY's balance sheet at the end of the first six months of 1997 did not include any long term liabilities. The Japanese loan was being formalised in November of 1997 and this will be the first significant capital injection into TDY.

## 6.4 Working Capital and Liquidity

**Working Capital Requirement**

The working capital requirements of TDY,defined as Current Assets minus Current Liabilities, are negative and have been decreasing. Current Assets as a percentage of Current Liabilities at the end of 1996 were only 57% and this had declined to 45% by the end of the first six months of 1997.

**Cash balance**

TDY's cash balance at the end of the first six months of 1997 was 4,608 million manats which was less than 2% of the reported current liabilities. This does not take account of the TDY balance that is held in the hard currency transport development fund. The amount of cash that TDY potentially had access to at the end of the first six months is not known.

**Fixed Assets as a percentage of Capital and Reserves**

It should also be noted that Fixed Assets as a percentage of total Capital and Reserves has been increasing over the last three years rising from 103% at the end of 1995 to 139% at the end of 1996 and to 153% a the end of the first six months of 1997.

# 7. Rail Operations

## 7.1 General

The TDY railway background, the railway network, the mode of traffic operation, the organisation and staffing, safety aspects, train operation and control districts, operational key parameters relating to speeds, axle loads, train lengths and loads, rolling stock details are fully described and set out in Appendix 12 attached to this report.

## 7.2 Present Traffic Volumes

It has been very difficult to collect data on traffic, especially the numbers of freight trains presently operated. Some data were made available but there is no precise breakdown of traffic in terms of sections, commodities etc. Where it was possible to collect data, these contained only parts of the traffic, like local traffic, and did not consider other parts, like transit traffic.

Traffic volumes in terms of numbers of trains as well as in terms of tonnage and passengers are low. This will be explained by an example. We have analysed the graphic timetables from 1988. This was one of the last years when the system was running at its actual capacity. We have then compared the figures with a specific day during the period of our assignment in Turkmenistan (i.e. 16$^{th}$ September 1997).

We are aware of the fact that this method only can deliver a snapshot of the actual system performance, yet it gives a picture of the actual performance.

| | | Turkmenb. / Bami | Bami / Ashgabat | Ashgabat / Douchak | Douchak / Mary | Mary / Tcharjou | Tcharjou Farap | Turkmenb. / Farap |
|---|---|---|---|---|---|---|---|---|
| | distance | 393 km | 166 km | 171 km | 172 km | 232 km | 33 km | 1.167 km |
| Details | track | ST | ST | DT/ST | ST | ST | ST | (DT) ST |
| | block | semi/autom. | semi/autom. | semi/autom. | semi/autom. | semi/autom. | semi/autom. | semi/autom. |
| trains in 1988 | freight odd dir. | 20 | 22 | 20 | 18 | 20 | 24 | |
| | freight even dir. | 20 | 22 | 20 | 18 | 20 | 24 | |
| | passenger | 8 + 8 | 8 + 8 | 10 + 10 | 8 + 8 | 8 + 8 | | |
| planned tonnage | odd dir. | | | | | | | 4200 |
| | even dir. | | | | | | | 3200 |
| number of wagons | | | | | | | | 57 wagons |
| number of trains 16/09/97 | freight odd dir. | 11 | 5 | 3 | 4 | 4 | 5 | |
| | freight even dir. | 9 | 3 | 6 | 5 | 5 | 3 | |
| | passenger | 2 + 2 | 3 + 3 | 6 + 6 | 8 + 8 | 5 + 5 | 8 + 8 | |
| freight trains odd direction | departure/arr. | 22h20/8h20 | 19h/22h57 | 7h35/12h | 5h45/8h/20 | 5h25/11h40 | 22h45/23h30 | |
| | trip time | 10h | 3h57 | 4h25 | 2h35 | 5h45 | 0h45 | 27h27 |
| freight trains even direction | departure/arr. | 11h12/21h45 | 5h30/9h50 | 1h35/5h30 | 20h25/23h45 | 2h30/7h42 | 3h40/4h50 | |
| | trip time | 10h33 | 4h20 | 3h55 | 3h20 | 5h12 | 1h10 | 28h30 |
| average speed | odd dir. | 39.3 km/h | 42 km/h | 38.7 km/h | 48 km/h | 44.6 km/h | 44 km/h | 42.7 km/h |
| | even dir. | 37.2 km/h | 38.3 km/h | 43.7 km/h | 51.6 km/h | 40.3 km/h | 28.2 km/h | 39.9 km/h |

Table 1□; Actual traffic situation on 16. September 1997

TDY has provided the following statistical figures for freight traffic:

| Description | Unit of Measure | 1995 Full Year | 1996 Full Year | First 8 Months 1996 | First 8 Months 1997 |
|---|---|---|---|---|---|
| Freight | Ml. T.Kms | 9,147 | 7,003 | 4,801 | 4,982 |
| Total Freight - Tonnage including: | Thousands | 10,068 | 8,000 | 5,416 | 5,616 |
| - Oil | Thousands | 2,963 | 2,101 | 380 | 1,720 |
| - Building Materials | Thousands | 4,705 | 3,328 | 2,197 | 2,711 |
| - Chemicals & Minerals | Thousands | 104 | 103 | 60 | 43 |
| - Cement | Thousands | 297 | 286 | 193 | 275 |
| - Grain | Thousands | 412 | 194 | 102 | 269 |
| - Chemical | Thousands | 117 | 111 | 63 | 24 |
| - Cotton | Thousands | 223 | 74 | 39 | 69 |
| - Other | Thousands | 1,247 | 1,803 | 2,382 | 505 |
| Unloading | Wagons | 530 | 443 | 446 | 465 |
| Statistical Loading | Tonnes | 55.6 | 56.7 | 56.3 | 57.4 |

**Table 2; Main statistical indicators freight traffic**
These figures appear not to include transit traffic.

The following table gives the main statistical indicators for developments in passenger traffic between 1995 and August 1997.

| Description | Unit of Measure | 1995 Full Year | 1996 Full Year | First 8 Months 1996 | First 8 Months 1997 |
|---|---|---|---|---|---|
| Passengers | Thousands | 5,242 | 7,237 | 4,974 | 3,805 |
| Passenger Kilometres | Ml. P. Kms | 1,876 | 2,103 | 1,513 | 646 |
| Passenger Trains - % of planned services operated | % | 94% | 85% | 85% | 91% |

**Table 3; main statistical indicators passenger traffic**

## 7.3 Future Traffic Volumes

Under the present economic situation, it is difficult to make reliable traffic forecasts for the railway. The prospects of economic development have not been clearly defined. In rail traffic very much depends on the relation to neighbouring railways and to which extent transit traffic can be won. Trends in rail traffic show that the drastic fall in rail freight traffic in Turkmenistan has continued in recent years, at least up to 1995. In 1996 and the first eight month of 1997 there is a trend for volume stabilisation, even signs of a slight increase.

The fall of passenger traffic has been less strong, since freight services are widely considered to subsidise passenger services and there are doubts about the potential for any long-term growth in passenger traffic. There has been a sharp decline in passenger traffic after a tariff increase in December 1996.

## 7.4 Freight Traffic

The severe drop in freight volumes has caused TDY to stop publishing timetables for freight trains. The train formation is based on operational targets and the stations form trains only when one of two pre-defined targets is met. These are:

- maximum gross weight, or
- maximum train length

Specialised freight container traffic does not exist. The transport of containers is subject to the rules and regulations applied to general freight traffic. The facilities to handle modern container traffic are not available. In Turkmenbashi, where there is a potential for an inter modal change from rail to road or ferry, the gantry is suitable for 20 tonne containers only.

As there is no timetable for goods trains, the customers cannot rely on the railway's operational system and there is no guarantee of a regular train service.

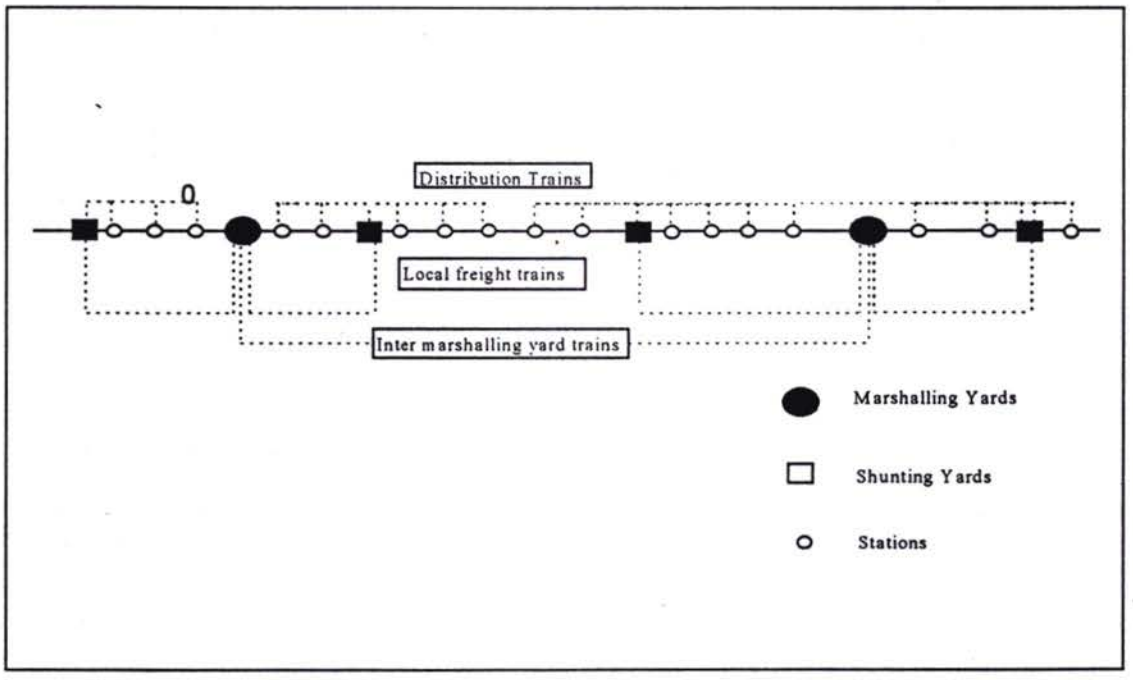
The transport of single wagons or wagon groups is performed in a hierarchical system of marshalling and shunting yards.

First level: the marshalling stations as well as the border stations are connected by inter-marshalling yard trains.

Second level: small shunting yards are subordinated to the marshalling yards. They have to form or split up local freight trains to and from neighbouring marshalling yards.

Third level: stations with sidings are subordinated to the shunting yards. Transfer trains operate between the stations and the shunting yards.

The system is as indicated in the following diagram :




At present no direct transit trains are running from Turkmenbashi to the Uzbek border. Wagons from Turkmenbashi are transported to the Uzbek border via Ashgabat and Chardjev as follows:

- through freight trains from Turkmenbashi to Ashgabat (marshalling station)
- through freight trains from Ashgabat marshalling station to Chardjev (marshalling station)
- transfer trains from Chardzhev marshalling station to the Khodzhadavlet border station (without intermediate treatment further to Bukhara)

In the opposite direction the following scheme is applied:

- incoming transfer trains from Khodzhadavlet border station to Chardzhev marshalling station
- through freight trains from Chardzhev marshalling station to Anau marshalling station (Ashgabat junction)
- through freight trains from Anau marshalling station to Turkmenbashi

Transit time: about 2 days.

Changing of locomotives: Nebit-Dag or Kazandzhik, Bami, Ashgabat/Anau, Dushak, Mary, Chardzhev, Khodzhadavlet

TDY has indicated that oil traffic from the Turkmenbashi region adjacent to the Caspian Sea takes a most circuitous route via Ashgabat and Chardjev, and through Uzbekistan and Kazakstan to Russia, incurring low tank wagon utilisation, long turn-around times and delay at border crossings. This is given as the main reason for the proposed railways line from Turkmenbashi to Yeralievo, giving a more direct connection to Kazakstan Railways and to Russia.

The continuing decline in freight traffic seems to have bottomed out and a small increase is shown for August 1997. TDY Commercial Department is confident, that further increases in freight can be expected.

The growth in freight traffic on the new line, connecting Tedjen to Sarakh and Iran has been very significant with a traffic volume in the first six months of 1997 being more than the entire freight volume in 1996.

## 7.5 Passenger Traffic

As in freight traffic, passenger transportation volumes have dropped sharply. In 1996 2.1 billion passenger km have been produced. 7.8 million passengers have been transported. The average trip length has increased steadily from 269.5 kilometres in 1992 to 357.9 kilometres in 1996. In December 1996 passenger tariffs were increased, which led to an additional drop of passengers, indicating how sensitive the market is for price increases.

TDY is operating passenger services on all lines of its system. A timetable is published for each station giving arrival and departure times of trains. The latest edition of the passenger timetable is from November 97.

The Chardjev area is the busiest in the system with twelve pairs of passenger trains. Chardjev region is the only region where commuter services are operated, to Farab and Seiki.

The key attributes of the passenger services are:

**Speed:** The maximum permissible speed for passenger trains is 100 kph. Because of deterioration of track speed restrictions had to be introduced. Basic operating speeds are the same for all categories of passenger trains. Passenger trains have priority over freight trains. The railway offers express trains with fewer intermediate stops.

**Reliability:** The reliability of the train services is still good, despite an increased tendency to equipment breakdowns, due to lack of spare parts for rolling stock and track maintenance.

**Safety:** Safety standards are very high.

**Flexibility:** The railway's capability to match passenger services to demand is not very much developed yet.

**Equipment Quality:** The age profile of the passenger coach fleet is quite advanced. Lack

of spare parts has a negative impact on the equipment quality. Equipment comfort is to standards of the previous Soviet Union.

**Customer Contacts:** Railway-customer contacts for passenger service appears to be satisfactory.

**Ancillary Services:** The railway offers some ancillary services to passengers like bedding on overnight trains and travel insurance. Some stations have kiosks selling amenities and food.

The fleet of coaches consists mainly of sleeper coaches, as they are in use in all the former Soviet Union countries. These coaches were designed for comfortable journeys, on a network of the size of that of the Soviet Union. Often thousands of kilometres had to be covered and travellers had to stay on board trains for several days. The manufactures' terminology for these coaches was "far distance traffic passenger coaches", an expression that describes the original purpose perfectly.

With the re-orientation of traffic in Turkmenistan, which followed independence, the travel distances have shortened. The average trip length of a passenger in Turkmenistan today is slightly above 300 kilometres. This is a distance where sleeper coaches are not required. In addition, sleeper coaches have some operational and commercial disadvantages. These are:

- **Low capacity.** The average utilisation of these coaches in Turkmenistan is 25 passengers.
- **High operation costs.** Each coach is staffed with coach attendants, bedding has to be provided and maintained.

Modern seating coaches which can seat 60 to 90 passengers have the advantage of a better utilisation ratio, cheaper interior maintenance costs, less personnel costs etc. Additional comfort features like air conditioning, video entertainment etc. can easier be implemented.

TDY has ordered fifteen new passenger seating coaches from Deutsche Waggonbau Aktiengesellschaft in Germany. Delivery of the coaches is expected from February 1998. There is yet no clear concept of how to utilise these coaches. The following options have been mentioned:

High comfort service between Ashgabat and Turkmenbashi
High comfort service between Asgabat and Mary
High comfort service between Ashgabat and Sarakhs

### 7.5.1 Operating schedule passenger service

The passenger timetable is established on an annual basis. It arises from the liaison between the Passenger Service Department, the passenger service unit in the Locomotive Department and the Track Maintenance Department. The three departments agree and prepare the timetable and the operating schedule, which then has to be sanctioned by the heads of all departments and the Director General.

Each service then complies with the requirements of the timetable. The Passenger Service Manager controls the maintenance of the coaches, the train crews, the water and heating fuel supply. The Locomotive Department is responsible for traction power and the crews of the locomotives.

The latest edition of the passenger timetable is dated November 1997. There are no major changes in this timetable except time adjustments. The number of trains, the train numbers and the destinations have remained unchanged.

Trains are operated in train pairs. There is a numbering system. From the train number the category of train can be derived. There are the following categories of trains.

| Train Category | Train Numbers |
|---|---|
| Intercity | 10 – 19 |
| Fast Train | 50 – 59 |
| Passenger | 100 – 299; 600 – 699* |
| Mail – Baggage | 900 – 999 |

**Table 4; train categories and numbering system**

*The numbers 600 – 699 are reserved for the commuter services Chardjev – Seidi.

At present, TDY is operating the following passenger trains:

**1. International Trains**

| Train pair | between | and | Frequency |
|---|---|---|---|
| 21/22 | Almaty (Kazakhstan) | Nukus (Uzbekistan) | 1 time per week |
| 53/54 | Tashkent (Uzbekistan) | Nukus (Uzbekistan) | 4 times per week |
| 57/58 | Volgograd (Russia) | Tashkent (Uzbekistan) | 2 times per week |
| 57/58 | Urgeneh | Volgograd | 1 time per week |
| 191/192 | Andivan | Urgeneh | 1 time per week |
| 297 | Andivan | Bezinavka | 5 times per week |
| 917/918 | Kungrad | Tashkent (Uzbekistan) | daily |

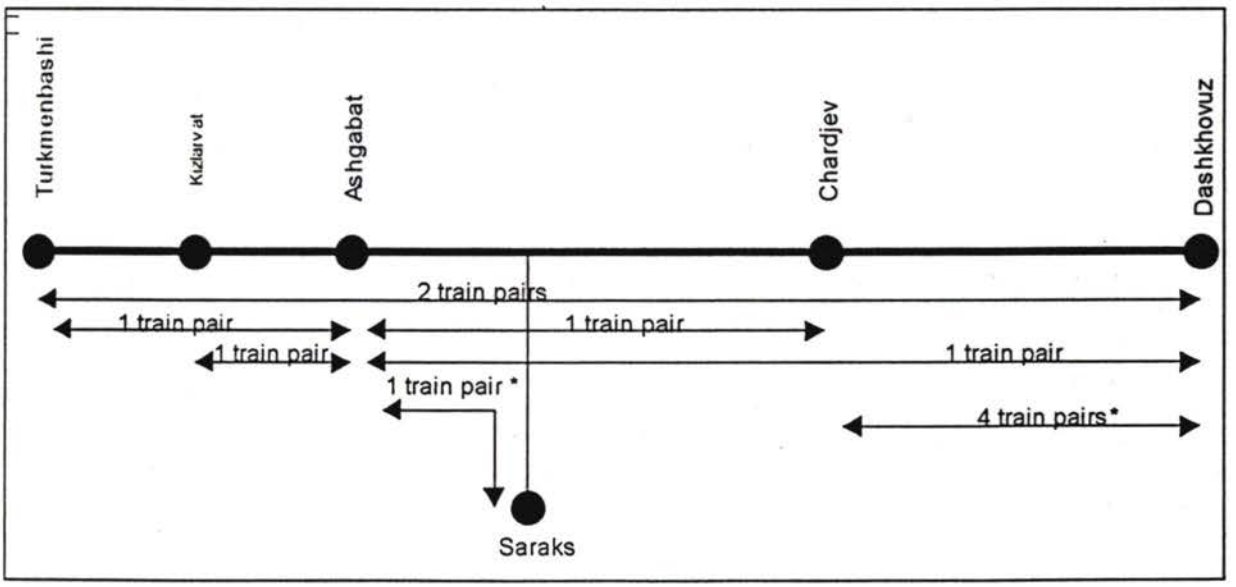
**Table 5; International trains**

**2. Domestic Trains**

| Train pair | between | and | Frequency |
|---|---|---|---|
| 11/12 | Ashgabat | Dashkhovuz | daily |
| 195/196 | Ashgabat | Chardjev | daily |
| 197/198 | Chardjev | Kelif | daily |
| 601/602 | Ashgabat | Gumgi | daily |
| 603/604 | Ashgabat | Kizlarvat | daily |
| 605/606 | Ashgabat | Turkmenbashi | daily |
| 615/616 | Ashgabat | Seraks | 3 times per week |
| 617/618 | Chardjev | Seidi | daily |
| 619/620 | Chardjev | Seidi | daily |
| 637/638 | Turkmenbashi | Dashkhovuz | daily |
| 939/940 | Turkmenbashi | Dashkhovuz | daily |

**Table 6; Domestic trains**

The following graph shows the maximum trainload in the various sections per day.




Figures marked with * represent the maximum load per day, since trains do not run every day.

## 7.6 Training

The operation personnel of TDY are well trained. Training is performed at the Transport and Communication Institute, opened in 1994. Training at the institute lasts four years, including practical assignments on the job.

Apart from operations training, training for mechanical engineers, permanent way engineers and signalling and telecommunication engineers is performed at the college.

## 7.7 Recommendations for Improved Efficiency in Railway Operations and Cost Reductions

TDY is operating a safe railway, designed to transport large quantities of freight and high numbers of passengers. In a changed environment, after the independence of the Republic of Turkmenistan, TDY has more or less continued previous operations on a low key level. The existing oversized infrastructure has not been adapted to changed necessities, the operation programme has remained unchanged and operating methods and the operating culture have begun to show signs of deterioration.

In addition, marketing structures have not yet been developed and the railway finds itself in a marketing environment, unfavourable of TDY, namely in the field of passenger services.

The following recommendations are made for the operation sector to overcome this situation.

### 7.7.1 Problem areas identified

Problem areas that have been identified by the consultant are :

over-dimensions and weaknesses of infrastructure

- too many stations
- too many tracks
- too many marshalling yards
- too many block sections
- container facilities not developed

operation programme

- train speeds are too low
- trains are too long
- train runs do not meet the demands of the customers

operation methods

- too many personnel involved
- utilisation of locomotives and locomotive crews is low
- no scheduling for freight services
- too much marshalling of freight trains
- no block trains

marketing concept

- disadvantages for the railway in competing transport modes

### 7.7.2 List of recommended actions

The following list of recommended actions relates to operations, but also to organisational aspects. It is a list of proposed actions to be implemented in order to improve efficiency, productivity and performance of TDY. The justification for each recommendation and a proposal for an approach is given below.

| N° | Action definition | Who | When |
|---|---|---|---|
| 1 | Increase the speed for both passenger and freight trains | TDY | ASAP |
| 2 | Re-introduce timetables for freight services with less marshalling and improved grouping | TDY | ASAP |
| 3 | Re-schedule passenger services; introduce several train categories with different speeds and comfort standards | TDY | ASAP |
| 4 | Improve locomotive and locomotive crew productivity | TDY | ASAP |
| 5 | Identify the stations no longer needed for crossings and passing of trains and remove the switching points, the loop track, the signal and telecommunication installations | TDY | next 5 years |
| 6 | Review the trackage of all remaining passing stations, marshalling yards and larger stations for what is actually needed and remove the access trackage | TDY | next 5 years |
| 7 | Review the freight operation system and close unnecessary marshalling yards | TDY | ASAP |
| 8 | Develop facilities to handle 20 and 40 foot containers at Turkmenbashi, Ashgabat, Mary and Chardjev | TDY | next 5 years |
| 9 | Remove subsidisation for Turkmenistan Airlines and introduce market prices | Government | ASAP |
| 10 | Open the network to other operators; introduction of a train path management | TDY, Government | next 5 years |

### 7.7.3 Justification of recommendations

The justifications and the proposals for an approach for the recommended actions are the following :

#### 7.7.3.1 Recommendation n°1

The low train speeds are not justified by any technical parameters. Both track and rolling stock parameters allow higher running speeds. At present the track allows maximum speeds of 100 km/h for passenger trains and 80 km/h for freight trains. The speed limits for locomotives is set at 100 km/h. the speed limit for coaches and wagons is higher.

Short term

We recommend an immediate speed increase for passenger services to 100 km/h and for freight trains to 80 km/h. The timetables have to be revised, the engineering recovery times have to be reduced, stops on line stations have to be reduced to 2 minutes.

Mid term

After a track rehabilitation and upgrading programme and the purchase of new locomotives for passenger services, the maximum speed for high comfort passenger trains should be raised to 140 km/h, that for freight trains to 100 km/h.

Approach

Based on the present train passenger train programme, the timetables for passenger trains should be re-calculated for a general maximum speed of 100 km/h. The existing speed restrictions have to be taken into consideration.

A clear line for stops for the different categories of trains should be established, following sequence:

| Train Category | Stops at |
|---|---|
| Intercity | cities with more than 30,000 inhabitants |
| Passenger | cities with more than 10,000 inhabitants |
| Mail & Baggage | stops at all stations |

For freight traffic the speed should generally be increased to 80 km/h

### 7.7.3.2 Recommendation n°2

Timetables for freight traffic should be re-introduced. We recommend the following general freight concept:

**1. Network Marshalling Yards**

Turkmenbashi, Ashgabat and Chardjev should be made network marshalling yards. Freight trains should be operating between these yards. All other marshalling yards should be closed (see recommendation No. 7).

Wagons for intermediate stations should be grouped according to the sequence of stations.

Freight trains from Turkmenbashi to Ashgabat should have the following grouping:

| Nebit- Dag | Kzandjik | Kizil-Arvat | Bami | Ashgabat | Locomotive |
|---|---|---|---|---|---|

Freight trains from Ashgabat to Chardjev should be grouped after the following scheme:

| Sarakhs | Tedjen | Mary | Chardjev | Locomotive |
|---|---|---|---|---|

Similar grouping should be applied for the opposite direction.

Dashkhvuz should be served from Chardjev using a similar grouping system for intermediate stations.

**2. Local Marshalling Yards**

Larger stations with considerable amount of freight traffic should have some grouping tracks, where the wagons for the network marshalling yard are pre-grouped.

### 3. Timetables

In a first stage, the timetables for freight trains should make provisions for regular freight trains and for special trains. The regular trains are to be operated according to schedule, regardless to the amount of wagons or the tonnage to be hauled. They are the basic grid for the freight system. The special trains operate, if the maximum load parameters of the regular trains are exhausted. We recommend the following freight trains to be scheduled:

| From – To | Regular Trains | Special Trains |
|---|---|---|
| Turkmensbashi Ashgabat | 5 | 5 |
| Ashgabat – Turkmenbashi | 5 | 5 |
| Ashgabat – Chardjev | 4 | 4 |
| Chardjev – Ashgabat | 4 | 4 |
| Tedjen – Serakhs | 1 | 1 |
| Serakhs – Tejen | 1 | 1 |
| Chardjev – Dashkavuz | 2 | 2 |
| Dashkavuz – Chardjev | 2 | 2 |
| Chardjev – Farap | 3 | 2 |
| Farap – Chardjev | 3 | 2 |

Should the amount of transit traffic between Uzbekistan and Iran increase, it is recommended to operate through trains between Chardjev and Serakhs or even Farap and Serakhs.

### 4. Block Trains

Wherever possible, block trains should be introduced. Cement and oil traffic have been identified as possible areas to introduce block trains.

In general, the main advantage of rail goods traffic lies in transporting large quantities of goods over long distances. Wherever possible, block trains should be implemented.

The benefits of block trains are:

Reduction of transport times; having positive effects both for the railway and the customers. Reducing the transport time increases the customer's acceptance for the rail services, lead to a higher competitiveness of the railway against other modes of transport and reduces operating costs by saving unnecessary shunting work.

Wagon and locomotive turn-around times can be reduced, which leads to a better rate of utilisation of the rolling stock.

## 7.7.3.3 Recommendation n°3

After the speed increase discussed in recommendation No. 1, the entire passenger services should be re-scheduled in a way to establish reliable, comfortable and fast passenger trains. The already existing concept of different train categories should be more emphasised by different speeds and different comfort standards.

We recommend upgrading the rolling stock for the Intercity trains and to make the trains shorter. An Intercity train set should consist of 7 to 8 air conditioned coaches, preferably open seat coaches. The train runs should not exceed 6 to 7 hours of travelling time. Intercity trains should run between the following cities:

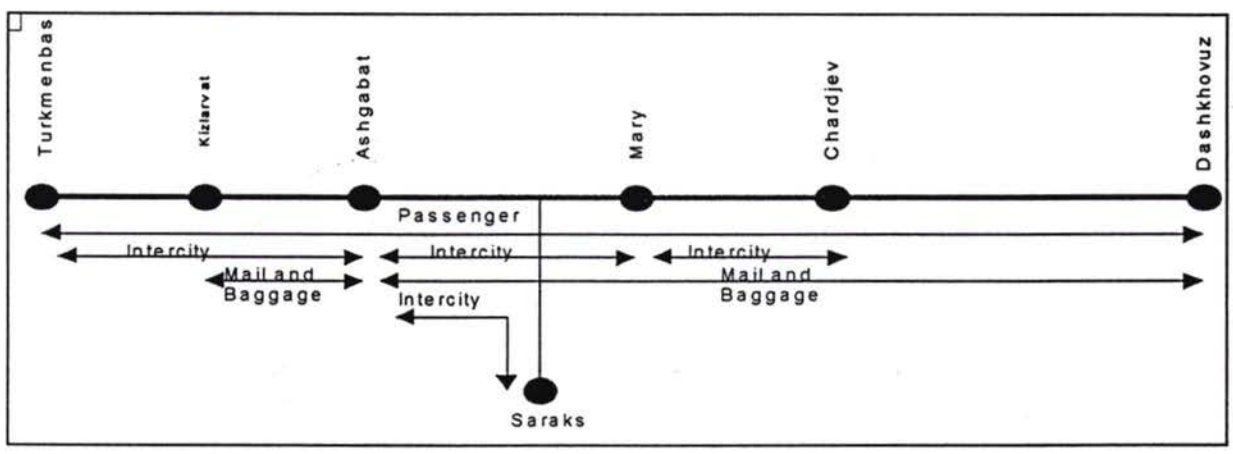
Turkmenbashi – Ashgabat
Ashgabat – Mary
Chardjev – Mary
and eventually Ashgabat and Serakhs

All Intercity trains should be branded trains.

As the next category we propose Regional trains. These should have long train runs. The train composition should be a mix of sleeper and open seat coaches. The trains should run between Dashkhovuz and Turkmenbashi and should stop at all major cities.

The next lower category are the mail and baggage trains. These have the function to provide transport for passengers from rural areas and postal services.

The following graph shows the proposed passenger train concept:




**For the Intercity trains we propose the following composition:**

| Intercity Trains | | Number of trains | | Required Locos | | Required Coaches | |
|---|---|---|---|---|---|---|---|
| Locomotive | Open Seat | Open Seat | Open Seat | Open Seat | Open Seat | Open Seat | Open Seat |

**The total rolling stock requirement for the Intercity trains will be**

| | | | |
|---|---|---|---|
| Ashgabat – Turkmenbashi | 2 | 2 | 14 |
| Ashgabat – Mary | 2 | 2 | 14 |
| Mary – Chardjev | 2 | 2 | 14 |
| Ashgabat – Serakhs | 1 | 1 | 7 |
| Total: | 7 | 7 | 49 |

The fleet will consist of the 15 coaches already ordered at DWA, Germany and of converted air conditioned sleeper coaches, proposed in the rolling stock part of this report. For locomotives we propose to purchase 5 new locomotives, capable to run 120 km/h over the next five years.

The trains should have a special appearance, so they can be easily identified by the customers.
The passenger trains should have the following train composition:

| LOCO | K | K | K | K | K | K | K | SW | R | OS | OS | OS | OS | OS | OS | OS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

K = 4 berth sleeper
SW= 2 berth luxury sleeper
OS= open seat coach
R = restaurant coach

Since the travelling time for the whole trip after the speed increase will be around 24 hours, 4 train sets will be needed to run a daily passenger train in both directions. The rolling stock requirements for passenger coaches will be:

| Passenger Trains | Number of trains | Required Locos | Required Coaches |
|---|---|---|---|
| Dashkhovuz-Ashgabat | 2 * | 4 | 60 |
| Total: | 7 | 7 | 60 |

Of the 60 coaches the requirements for different types of coaches will be:

| Type of coach | Number of coaches |
|---|---|
| K | 28 |
| SW | 4 |
| OS | 28 |
| Total: | 60 |

It is recommended to leave the mail and baggage trains unchanged for the time being

### 7.7.3.4 Recommendation n°4

The productivity of both locomotives and personnel need to be improved. In order to achieve this it is necessary to:

- increase the daily running performance of locomotives,
- introduce rosters for assignment of locomotives,
- introduce duty rosters for locomotive crews.

The present daily average running performance of locomotives is very low. We recommend the locomotives to be assigned to a train from start to beginning. The locomotives should be rostered according to the freight and passenger timetables.

With longer locomotive runs, a number of depots can be closed. Our investigations have shown that the only the following depots are needed:

- Turkmenbashi
- Ashgabat
- Chardjev

For reasons of the present network structure and isolation from the main network, the depots in Dashkhovuz and Amundaria have to be kept at present. After completion of the new line from Chardjev, the Amundaria depot can be closed as well.

Running sheds should be provided in

- Gazianjik
- Mary

Fuelling facilities should be provided in Gazliabad and in all stations, where shunting locomotives are deployed.

The locomotive crew can be changed en route, if the drive exceeds the working time of 8 hours.

For the working time of drivers we propose to change the regulation in such a way that the daily working time might be up to 12 hours, but the average weekly working time should not exceed 40 hours. This gives a higher flexibility in the assignment of locomotive personnel and is common practice with many European railways. An example for such a duty plan is given below:

| Week day | working time in hours |
|---|---|
| Monday | 8 |
| Tuesday | 12 |
| Wednesday | 8 |
| Thursday | 6 |
| Friday | 6 |
| Weekly total: | □ =SUM(ABOVE) □40□ |

Personnel and locomotives should be rostered individually and locomotive personnel should, in the long run, be transferred to the operations department.

### 7.7.3.5 Recommendation n°5

The average distance between stations on the TDY mainlines is 7.5 kilometres. This is way above the requirements needed for the present and future operations programme. We recommend to close the stations no longer needed for crossings and passing and to remove the access tracks and switching points.

For this purpose it is necessary to conduct line capacity calculations. We propose calculations based on the the internationally recognised Method of Line Capacity Calculation according to UIC 405 R the details of which are set out in Appendix 12 attached to this report.

Arising from the calculation of the line capacity in accordance with UIC 405 R and at the present maximum speed of between 40 km/h and 60 km/h and an average distance from station to station of 7.5 kilometres, the typical section capacity would be 55 trains per day

With the speeds for all passenger trains increased to 100 km/h, the typical section capacity would be 65 trains.

We recommend the closing of every second wayside station. This would bring the average distance between stations up to 15 kilometres. The line capacity at an average speed of 60 km/h would still be more than 45 trains per day. This is more than double what is actually operated.

The materials recovered by this exercise should be taken into stock and used as spares. Especially, the signal and telecommunication parts will extend the lifetime of the signalling and telecommunication system.

#### 7.7.3.6 Recommendation n°6

We recommend the tracks and sidings in all remaining stations to be reviewed under the aspect of keeping only the tracks and installations which are used.

This again would decrease the maintenance costs and increase the stock of spare parts and material for permanent way and signal and telecommunication systems.

#### 7.7.3.7 Recommendation n°7

As a result of recommendation No. 2, many marshalling yards will be no longer necessary for the freight system. These marshalling yards should be closed. As a first step, we recommend the closure of Annew marshalling yard close to Ashgabat. The work presently performed at Annew should be shifted to Ashgabat.

#### 7.7.3.8 Recommendation n°8

Containerisation will be a key aspect of future rail freight traffic in the entire region. TDY has to prepare for this development by providing container facilities, which can handle 20 and 40 foot containers (the 20 foot container relates to one Traffic Equivalent Unit ). We have identified Turkmenbashi, Ashgabat, Mary and Chardjev as locations for container terminals.

#### 7.7.3.9 Recommendation n°9

The prices for passenger tickets are too high, compared to other transport modes, as will be apparent from the comparative table in section 5.1.3.1, and TDY need to review this pricing situation..

#### 7.7.3.10 Recommendation n°10

In the course of the next five years the railway network should be opened to other operators, both domestic and international. There are already some pilot projects with privately operated container trains on the way in the region.

For TDY we have identified the possibility to market train paths on the main line from Turkmenbashi to Farap and from the Iranian border at Serakhs to Farap at the Uzbek border.

TDY should assess the value of train paths and should market these train paths.

## 7.8 Marketing, Product Development And Planning

The TDY of 2000 will be a market oriented business and must provide services which the customer requires at a price he is prepared to pay but which meet all the financial needs of TDY to cover its operating costs and provisions for the future to keep it in business. It follows from this that TDY must know all about its customers - existing and potential; their areas of business and processes, their opportunities for using other forms of transport; what they can afford or are willing to pay for transport; how their transport requirements can best be met by railways; what steps can or should be taken to shape movement patterns to assist TDY in providing the best and the most economical patterns to mutual advantage.

This wide spread of knowledge is what is meant by knowing the market or "marketing" and TDY must become fully competent in this area. It must develop experts in the markets for particular commodities of goods or passenger services, who will be able to guide TDY in understanding the needs of their customers and converting them into service specifications which will tell the operating department how they should be met. This knowledge will be the basis of all future investment in physical assets - each project must be supported by an evaluation of the way in which it will encourage new business or help existing business to be more profitable.

The accumulation of marketing ideas and project plans forms the overall business plan, which in turn is backed up by the operating plan, which describes how the business plan is to be serviced and the engineering plan which details the resources used and technical activities which are in support. The financial aspects of each of these plans are revealed in the budget - the financial plan - and there will be an investment plan which will contain all the proposals for investing in new assets to maintain the railway in good physical state or improve its quality and to meet new opportunities.

## 7.9 The Commercial Approach To Operations Management

A railway pursuing commercial objectives has a totally different management approach from one which focuses on producing transportation with little regard to the amount of equipment employed, the productivity with which it is used or the resulting costs. Equally important is the fact that business has now to be obtained against powerful competition and changing economic and social factors and is no longer directed to rail by decree.

Institutionally, these factors are recognised in the proposed new status of TDY, including the new statutory background, the Performance Agreement and the Public Service Contracts for unremunerative services. The Director General and the Directors will have full and accountable responsibility for achieving results and are strengthened in this by their membership of the Executive Board, which may also include members with wider responsibilities in government and industry, who can contribute different expertise, experience and guidance.

The approach of management to its task - its working style - is now different. It focuses, particularly, upon:

- the overriding need to secure profit;
- determination to provide railway service only for traffic types and flows which can be made profitable;
- recognition that many previous railway activities are not profitable and cannot be made so and therefore must not be pursued by TDY unless directed by government and accompanied by full financial compensation;
- a critical approach to productivity and economy;
- a thorough understanding of customers' interests, business activities and processes and the mutual benefits arising from jointly planned movements by rail;
- a complete knowledge of the activities, charges, strengths and weaknesses of competitive transport systems;
- a comprehensive understanding of railway costs, their causes and the way they behave under the influences of changes in volume, operating methods or external influences etc;
- the application of a frugal instinct, which seeks to achieve the maximum output from the minimum input of resources;
- the devolution of responsibility and accountability to the lowest possible level where a comprehensive view can be obtained and effective decisions taken. This dictates the subordinate organisation structure and guides the concentration of traffic and location of operational resources which will maximise the potential for productive results and delegated responsibility and authority;
- the support of this delegation of management by a firm system of control made possible by a comprehensive computer driven management information system. This operates by the input of data at original source through the distributed computer network and new communications links and the production of information in forms meaningful to each level and location of management;
- the principle that plans and budgets begin at the lowest level and are consolidated and developed as they move up the chain to the Director General by monitoring, rectification and improvement.

# 8. Infrastructure

## 8.1 Statistical Data On The Infrastructure

The gauge of TDY track as in all former Soviet Union network is 1,520 mm. The main characteristics of the network are as follows :

| | | | | |
|---|---|---|---|---|
| Track | | | | |
| Length of lines | 2313 | km | | |
| Double track | 33 | km | | |
| Length of track | 2349.5 | km | | |
| Service track | 544.2 | km | | |
| Tracks in stations | 492.7 | km | | |
| Loops | 168.1 | km | | |
| Rail | | | | |
| R75 | 54.6 | km | 1 | % |
| R65 | 2573.27 | km | 63 | % |
| R50 | 917.8 | km | 22 | % |
| R43 | 542.85 | km | 13 | % |
| Equipment | | | | |
| CWR | 1737.7 | km | 74 | % |
| RCS | 1798.8 | km | 82 | % |
| Cs | 386.7 | km | 18 | % |
| Switch and crossing unit | 764 | u | | |

The standard track is made up of:

- rail 65kg/m
- reinforced concrete sleepers (RCS) laid every 54 cm (1840 CS/km)
- type KB65 fastenings
- ballast layer of 30 to 35 cm.

82% of the track is laid on reinforced concrete sleepers. The TDY is planning a programme to replace existing wooden sleepers with RCS. 74% of the rails are made up of continuously welded rail ( CWR.). CWRs are limited to 800m in length and the expansion device is made up of 3 rails of approximately 12.5m located at each end of the long rails.

Operatives have available to them two sets of rail sections which differ in length by 4cm (12.38M;12.42M;12.46m) to allow the joints to be adjusted according to the temperature of the rail.

## 8.2 General State Of The Track

On-site visits and inspections indicate that the track is, on the whole, in quite a good state of repair.

- The geometry of the track is relatively good.
- The sleepers and rails are in a good state of repair.
- The fastenings are well fixed and have no trace of corrosion.
- The switch gear is suitably greased.
- The main apparent defect is the poor quality of the layer of ballast both in terms of ballast quality (polluted, deteriorated ballast) and the inadequate depth under the sleepers.

The state of temporary speed restrictions shows that, at the moment, approximately 150 km of track have speed limits imposed because of the poor quality of the track, that is 6.5% of the network.

This figure is not bad but any increase must be avoided.

## 8.3 Organization Of The Maintenance

Maintenance is carried out by the following organisations:

### 8.3.1 Maintenance Area Groups

- Track Maintenance area of Ashgabat
- Track Maintenance area of Amou-Daria
- Track Maintenance area of Tchardjoou
- Track Maintenance area of Dargan-Ata
- Track Maintenance area of Mary
- Track Maintenance area of Kouchka
- Track Maintenance area of Bezmein
- Track Maintenance area of Kajandjik
- Track Maintenance area of Turkmenbachy
- Track Maintenance area of Tachaouz

There is a minimum of 300 persons per area, which manages an average of 250 km of track. Each maintenance area consists of 10 to 16 districts, which maintains about 15km of track, and has between 3 and 4 gangs with between 7 and 20 people in each gang.

### 8.3.2 Mary Maintenance Area

The Mary area is responsible for maintenance work on 237 km of main line track.
It has a work force of 300 operatives. In the area there are 274 switch and crossing units and 26 level-crossings of which 8 are guarded. The area has only small tools available and practically all the maintenance is carried out manually.

A large part of maintenance operations consists in dealing with problems of electrical insulation putting safety installations in danger. The biggest problem is faulty insulation on the reinforced concrete sleepers. A large part of the areas's work is the manual replacement of sleepers showing mechanical or electrical defects. There is also a great deal of work carried out on insulated joints.
The staff in the districts carry out manually (jacks and manual tampers) levelling and lining repair work and in particular levelling the joints.

The area has a special division dedicated to searching for defects in the rail. The « defectoscope » travels over each sector of the main track 3 times a month.

About 10% of crossings in switch and crossing units are defective. The resurfacing of crossings by welding build up is considered to be unreliable and is no longer used.

### 8.3.3 Charjou Area

It comprises 530 employees of whom 35 are administrative. They are divided into 16 geographical subdivisions or districts.

We inspected the area's transport equipment which included:
- lorries for the transport of materials
- lorries for transport of personnel
- a track lining machine (under repair ...)
- a mobile engine fitted with an unbolting/bolting plate.
- a track car
- a track car fitted with a crane.

In the sector, the following speed restrictions are in force:

- 40: on the Amou Daria bridge
- 40 and 60 : over the switch and crossing units (it may be thought that 10% of the crossings on the main track are defective).
- 80: delay over the track renewal work areas.

The main work of the operatives in the area is:

- levelling/lining (including levelling the joints)
- replacement of damaged sleepers
- replacement of rails.

### 8.3.4 Basic Repair Groups

TDY has 3 main basic repair groups as follows :
- PMS1 of Tachaouz
- PMS2 of Mary
- PMS3 of Kizyl

The mission these groups have is to carry out basic operations, which consist of track and ballast renewals. Track renewal is carried out using the panel method. These groups have the mechanised equipment needed to carry out this work.

#### 8.3.4.1 Example of the PMS2

The Mary PMS2 has 200 operatives. It is made up of :

- a site for the assembly of new panels equipped with 3 gantry cranes.
- a site for dismantling panels equipped with 2 gantry cranes.
- a fleet of machines for renewal and laying work.

The machine fleet is, in essence, made up of:
- **1 clearing machine** (not present on the site)
- **1 Platov lifting crane**

This first crane is for lifting 12 m sections of old track.
It has a load bearing capacity of 9 tonnes.
- **1 bulldozer** For shaping the ballast

- **1 Platov laying crane**

This second crane is for laying 25m sections of new track assembled at the Mary assembly site. It has a load bearing capacity of 18 tonnes.

- **trains for transporting panels**

Specialised trains for ferrying old and new sections between PMS and the site.

- **VPO track vibrator**

This machine is used in place of a tamper
It raises the track using magnetic pads placed on the rail and pushes the ballast underneath using side-mounted metal plates.
The VPO seen at the Mary site was a new machine, made in Russia and not yet used.
Each PMS usually has a geographical sector within which it carries out renewal work.
However, at the moment, all the PMS are working on the new line.

## 8.3.5 Other Groups

- PDM Machinery repair shop
- RSP Rail repair train
- Group responsible for plantations to counter the effects of sand

These 3 groups are based in Charjou.

### 8.3.5.1 Machinery Repair Shop

This plant is responsible for maintaining heavy track equipment which means in essence the machinery belonging to the PMS. The plant also produces small tools for Way & Works staff.

Its work force amounts to 55, including 11 administrative employees. It comprises:

- **The engine shop** where diesel engines are repaired.
- **The mechanical workshop** equipped with machine tools producing parts for the engine shop or the machine shop.
- **The forge** producing tools for track operatives such as spanners, crowbars, brake shoes etc. from rail sections.
- **The machine shop** where maintenance, repair and modification of machinery is carried out.

### 8.3.3.2 Rail Repair Train

The main role of the unit is the production of Continuous Welded Rails
The unit comprises 55 people, and is made up of 4 workshops:

**The CWR shop**

The continuous welded rails are produced from 12.5 or 25m rails and are manufactured on request. They have an average length of 700 m.

**The Glued Insulated Joints shop**

This workshop manufactures GIJs. It is no longer operating because of a lack of parts required for manufacture (insulating profiles).

**Welding machines**

The plant has 4 welding machines which are designed to carry out electrical welding on the track and are used for the repair of rails and replacement of rail sections.

**Rail Grinding Train**

This is a train designed specifically for grinding rails. The train is used to repair rail incident damage, skid marks, for example.

#### 8.3.3.3 Group In Charge Of Plantations.

Responsible for plantations in the Turkmenistan desert to protect the track against sand. Where such planting is impossible, reed barriers are erected. The sand does a great deal of damage to the installations. attempts are made to protect the track by planting shrubs or planting short grass in criss-cross patterns on the dunes.

## 8.4 The Staff

4,600 people are employed in all these units.
Executives and managers are trained by the Ashgabat Railway Institute.

## 8.5 The Track Equipment

### 8.5.1 Rails

| Rail | | | | |
|---|---|---|---|---|
| R75 | 54.6 | km | 1 | % |
| R65 | 2573.27 | km | 63 | % |
| R50 | 917.8 | km | 22 | % |
| R43 | 542.85 | km | 13 | % |

74% of rails are laid as CWR. The CWRs are limited to 800m. The expansion unit is made up of 3 rails of approximately 12.5 m. located at each end of the long rails.
Operatives have available to them two sets of rail sections which differ in length by 4 cm (12.38m;12.42m;12.46m) and allow the joints to be adjusted according to the temperature of the rail.

The block sections are 1500m long. The joint between 2 block sections is, in the main, a glued insulation joint made up with two 12.5 m rails and placed in the centre of the expansion device.

### 8.5.2 Sleepers

#### 8.5.2.1 Wooden Sleepers

About 18% of all sleepers are wooden. There is a major maintenance problem due to the use of spikes. The rails are fastened to the wooden sleepers using cramp irons/spikes. It appears that rails are not treenailed to the sleepers. Three possibilities are offered :

1. Increase the life of the sleepers by treenailing; this first solution would be expensive to implement in TDY considering the length of sections with wooden sleepers ( less than 500 km )
2. Replace old wooden sleepers by new ones which will not solve the problem in the long term. It is an expensive solution considering that the life is short due to the maintenance practices, the quality of the wood (pine) is poor and that all wooden sleepers must be imported.
3. Replace old wooden sleepers by new concrete sleepers. While the investment cost is higher, the life of the concrete sleeper is more than twice the life of the timber sleeper, the maintenance to be carrried out is reduced, and accordingly the overall cost is reduced, and this solution is recommended.

At present about 26% of wooden sleepers are faulty. Wooden sleepers are being gradually replaced by concrete, except in those areas where 43kg/m rail is used, since no suitable concrete sleeper is available for this rail section.

#### 8.5.2.2 Concrete Sleepers

About 82% of all sleepers are concrete and are produced locally by a new factory.
Annual production is, at the moment, 240,00 sleepers but the factory has not yet reached full output. It is planned to manufacture concrete bearers for switch and crossing units to replace timber work in these units.

The normal number of sleepers is 1840 sleepers per kilometre on main line tracks, with 2,000 per km on curves and 1,600 on service tracks.

### 8.5.3 Fastenings

The KB system is used. There are 11 types of fastening (according to type of rail, baseplate, pads). TDY has to face several major problems :

- The railways are faced with a serious problem of spare parts.
- Maintenance of the fastenings is very intensive.
- Serious corrosion problems are evident on the fastenings, in particular on the anchor bolt.

These problems lead to poor rail-holding (causing slow zones) and cause problems with electrical insulation. It would be useful to investigate adapting European fastenings (VOSSLOH,Pandrol,NABLA) to this type of sleeper.

### 8.5.4 Ballast

Ballast is produced in Turkmenistan by 3 quarries:
Bezmein
Turkmenbashy
Amou-Daria

The latter is closed at the moment since its location involves crossing into Uzbek territory. However, it is planned to put it back into service for the continuation of construction work on the Charjou/Kerki line.

In general track ballast is of insufficient depth and of fairly poor quality. The quantity of ballast laid on the track is often too little to give a satisfactory ballast profile. Site visits also show that the ballast generally has a low hardness quality.

### 8.5.5 Switches and Crossings

The main problem with maintaining the switches and crossings is the supply of spare parts, as 68% of switches and crossings are at the moment, faulty.
Resurfacing of crossings has been abandoned since faults appear rapidly after resurfacing (problem of methodology and, above all, of electrode quality).
New supplies of crossings and points are urgently required as wear on crossings is one of the main causes of speed restrictions (40 or 60km/h).

### 8.5.6 Glued Insulated Joints

The poor quality of glued joints causes numerous electrical insulation faults which originate several signalling incidents. The repair of insulation faults is the cause of a large amount of work within the maintenance units. The visit to Chardjev glued joints workshop demonstrates that the production of these items had to be stopped due to the lack of components. Arising from this the insulated joints found in the track are frequently produced on site with textile components and this type of joint has a poor mechanical quality and is quickly degraded in service.

The improvement of the Chardjev workshop is one of the major priorITIES, AND CAN be achieved through :

- purchase of standard spare parts
- purchase of proprietary manufactured glued joints

## 8.6 Drainage

Because of the dry climate in the country, there are no particular drainage problems. Concrete gutters exist at stations. There is a minor flooding problem at Geoke Tepe which will be solved by the installation of a concrete drain crossing the track.

## 8.7 Types Of Operation

### 8.7.1 Basic Repairs : Renewal Of The Track And Ballast.

These operations are instigated automatically when 750,000,000 gross tonnes have used the track. Over the last few years, efforts have been concentrated mainly on the construction of new lines, a fact which greatly delays renewal operations. Delays in carrying out renewal operations cause the imposition of speed limits.

The method used for the complete renewal of track and ballast is the panel renewal method as follows :

1 25m 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 short term service rails in panels are replaced by continuous welded rails.

The average work rate for this type of work is about 1000m per shift.

### 8.7.2 Medium Repairs

Intermediate repairs while awaiting track renewal , started in the middle of the total renewal cycle. They concern sleepers, rail or ballast. The extent of the work is established according to the state of the track. Replacements must not exceed 25%. In general, this work is

mechanised and carried out by the PMS. For the reasons quoted previously, these operations are behind schedule.

### 8.7.3 Corrective Maintenance

These operations are carried out by the track maintenance areas. The most common operations are:

- levelling joints
- lining
- levelling running line
- replacement of sleepers
- replacement of switch gear crossings
- replacement of rails
-

These operations are most frequently carried out manually.

## 8.8 New Line

The railways are in the process of constructing a new line between Chardjou and Kerki allowing the Talimarjan/Afghan frontier section to be connected. the line will be 215 km long. 90 km of earthworks have been completed and 43 km of track has been laid. Works are slowed up due to lack of materials.

## 8.9 Civil Engineering

The split of bridges is shown in the following table:

| Item. | No |
|---|---|
| Metal bridges | 8 |
| Mixed bridges | 16 |
| Concrete bridges on piles | 52 |
| Concrete bridges | 639 |
| Foot bridges | 10 |

### 8.9.1 Bridge Over The Amu Daria

The bridge dates from the beginning of the century. The bridge is single track and is made of riveted metal. The construction is showing serious signs of fatigue:

- cracks in the horizontal beams;
- weakness of the rivets at the haunches

A study carried out in 1990 by the Moscow Institute of Transport gives an alarming picture of the structure of the bridge and especially on the strength of the rivets. Replacement of the bridge should be planned for the near future. Reconstruction of the bridge is the subject of another study and investment programme.

### 8.9.2 Bridge Over The River Tedjen

The bridge was built in 1898. It has two spans of 38.5 metres. Following a derailment in 1993, the span on the Mary side was damaged and replaced with a temporary structure. The

rise in the level of water in the river Tedjen is such that the height of the bridge is insufficient. TDY plan to replace this structure by a bridge with a single span of 88 m. and the work should start in the near future. Speed on the bridge is limited to 50km/h.

### 8.9.3 Bridge Over The Karakoum Canal

The original damaged bridge has been replaced by a temporary bridge built parallel to the original. A lateral track has been constructed in parallel to cross the canal. Speed on the bridge is limited to 40km/h.

## 8.10 Track Maintenance Manning Levels

The mechanisation of the track maintenance and the improvement of the track components will permit considerable reduction in the manning strength of the track maintenance areas. Many hours are spent in :

- track packing and lifting
- track aligning
- ballast cleaning
- replacing sleepers
- repairing and replacing glued joints

The acquisition of tamping machines, ballast cleaner, and ballast regulators will permit the recovery of a substantial amount of hours involved in the three first operations. The acquisition of sleeper inserters and the improvement in the quality of the sleepers will reduce the amount of post < ballast replacing > work. The improvement in the quality of glued insulated joints will reduce the amount of maintenance input into this troublesome track feature.

Today, a track maintenance area is responsible for about 250 km of track. Each area is divided into districts responsible for about 15 km of track. Without making any alteration in the area boundaries, we can enlarge the action zone or working length of each district to an average of 10 districts for each area. Each district would have charge of 25 km of track and a maximum strength of 10 people per district on a mobile basis is estimated to be sufficient to back up the mechanised maintenance system in the field, and carry out all of the immediate repairs and tasks which it is not possible to mechanise. The people in the districts involved in track maintenance would be equipped with modern powered tools to improve their efficiency and enable them to get greater productivity.

The structure of an area could be as the following :

| | |
|---|---|
| Chief of area | 1 |
| Administrative assistant | 1 |
| Technical assistant | 1 |
| Technical deputies | 4 |
| Team leaders | 10 |
| Team personnel | 100 |
| Tools workshop | 10 |
| Defectoscope | 10 |
| Machine operators | 10 |
| Administration | 10 |
| **Total** | **157** |

Today, the average strength of an area is about 300 people, and the above manning level would show a saving of staff of approximately 50%, making a manning level of 0.6 persons pER TRACK KM, WHICH COUld be further reduced over a time period of five years to a level of 0.5 persons per track km.

## 8.11 Recommendations

### 8.11.1 Improvement Of Track Components

In a general way, maintenance suffers considerably from a lack of spare parts.
The objective of the investment is:

- to head off urgent situations by supplying crossings and sleepers.
- to prolong equipment life by providing technical assistance in resurfacing rails and crossings.
- to improve the self-sufficiency of the TDYs by investing in the sleeper factory and the quarries.

### 8.11.2 Repair Of Steelwork In Crossings

We have stated that wear on the crossings was the cause of many speed restrictions being imposed. The crossings inspected were too worn for resurfacing to be contemplated.

**Assistance and training on resurfacing of crossings by welding**

The railways have abandoned the technique of resurfacing crossings by welding and they do not use the technique on rails (repair by replacing rail sections if the fault cannot be repaired by grinding).

The technique of resurfacing was abandoned since it was considered to be unreliable.
This technique which is widely used on western rail networks, gives large savings in equipment.

| | |
|---|---|
| Action | Purchase of replacement crossings, and assistance with welding training |
| Budget | 500 000 US $ |

### 8.11.3 Concrete Sleepers (To Replace Timber Sleepers)

Replacement of timber sleepers is considered to be a priority.
However, supplies of sleepers are insufficient to allow this operation to be carried out rapidly.
We suggest an investment for the purchase of 500,000 fitted reinforced concrete sleepers which will be used as a priority to replace the existing wooden sleepers. The Consultants are of the view that any new concrete sleepers should be provided with a modern high quality elastic fastening, to enable maintenance costs be reduced, but TDY are not convinced of the merits of this change, and wish to retain the existing KB fastening, which they find to be adequate. Accordingly the cost of elastic fastenings is not included in the sleeper cost.

| | |
|---|---|
| Action | Supply of 500,000 RCS |
| Budget | 14 000 000 US $ |

#### 8.11.3.1 Improvement Of Concrete Sleepers Factory

The objective is to make the railways very quickly self-sufficient in terms of supplying sleepers.
The objective of the investment is to:

- increase RCS production

- permit production of concrete bearers for switches and crossings
- carry out research to improve the quality of the rail/fastening set, currently critical in terms of electrical insulation.

| Action | Investment in the factory |
|---|---|
| Budget | 1 000 000 US$ |

### 8.11.3.2 Improvement Of Ballast Quarries

The depth of the ballast layer is inadequate over a large part of the main track.
In addition, it appears that the quality could be improved.

The investment in ballast quarries should allow:

- production to be increased in order to allow installations to be properly furnished, and
- the quality and granularity of the product to be improved, in accordance with the following specification :

**Specification for track ballast**

The ballast shall be good hard stone, angular in shape with all dimensions nearly equal. It shall be washed, clean and free from dust. The ballast shall consist of a mixture of sizes according to the following grading percentages (by weight ) following sieve analysis :

| sieve size | %age to pass |
|---|---|
| 63mm | 100% |
| 28mm | 20% |
| 14mm | 0% |

The 80% retained on the 28mm sieve shall be evenly graded between 28mm and 63mm

**Test requirements**

| | |
|---|---|
| Aggregate crushing value | 30%max. |
| Aggregate impact value | 25%max. |
| Flakiness Index | 30%max. |
| Elongation Index | 40%max. |
| Wet attrition value | 7%max. |

| Action | Investment in quarries |
|---|---|
| Budget | 1 000 000 US$ |

## 8.11.4 Improvement Of Maintenance

### 8.11.4.1 Tools

At the moment, a large part of maintenance is carried out manually. The small tools which operatives have are often obsolete and repairs are becoming more and more difficult.
This investment should allow all se ctions to be re-equ i pped with the adequate tools.

| Item | Each (US $) | Qty | Price |
|---|---|---|---|
| Mobile generators | 8 833 | 50 | 441 650 |
| Rail saws | 9 033 | 50 | 451 650 |
| Hydraulic Jacks | 1 158 | 200 | 231 600 |
| Rail drills | 6 967 | 50 | 348 350 |
| Power spanners | 4 567 | 50 | 228 350 |
| Electric spike drivers | 9 857 | 20 | 197 140 |
| Electrodes (for resurfacing) | 20 | 2000 | 40 000 |
| Trolleys 1t | 437 | 100 | 43 700 |
| Trolleys 4t | 4 028 | 10 | 40 280 |
| Total | | | 2 022 720 |

| Action | Purchase small tools |
|---|---|
| Budget | 2 000 000 US$ |

### 8.11.5 Mechanization Of Maintenance

Maintenance of the track is mainly based on the large-scale work cycle (complete renewal) and on the intermediate maintenance cycle (replacement of part of the track equipment). These operations are carried out by the PMS and are highly mechanised. For complete renewal, for example, very well designed purpose-built machinery can be used which gives an average rate of 1000m per shift. The lack of materials, and the almost continuous use of the machinery for the construction of new lines, leads to delay these large-scale operations making it more and more important to carry out corrective maintenance.

In contrast with this high level of mechanisation, the very low levels of mechanisation in corrective maintenance must be noted. Practically all maintenance work is manual in spite of the heavy track equipment which makes operations very difficult and very long.

Our proposal is, therefore, to totally mechanise corrective maintenance, so as to give it greater importance, allowing the delay in large work programs to be reduced and permitting the track to be maintained to a uniform high quality in a more efficient way at a lower cost.

The operations most often carried out by maintenance plants are levelling-lining of the track and switch gear and the replacement of sleepers.

#### 8.11.5.1 Tamping Machines

The track levelling machines used in Turkmenistan are the VPOs. This machinery is used in essence for construction work and large-scale renewal work. We recommend the purchase of type 08 mixed tamping machines for running track/switch and crossing work.
These tamping machines can treat in excess of 1000 m per shift or approximately 350 km per year. We recommend the purchase of 4 tamping machines capable of tamping 1400 km of track per year, that is in excess of 60% of the main tracks.
They will be attached to one maintenance area out of two.

Tamping machines may be sited in:
- Kazandjik
- Ashgabat
- Mary
- Chardjev

| Action | Purchase of 4 type 08 mixed tampers |
|---|---|
| Budget | 7 000 000 US$ |

### 8.11.5.2 Equipment for a Sleepers Inserters Gang

Sleeper replacement operations are very frequent. The sleepers are replaced for either mechanical reasons (breaks, cracks), replacement for wooden sleepers, or because they have insulation defects. These operations are very difficult to carry out manually when reinforced monobloc very heavy concrete sleepers have to be replaced.

We propose investment in equipment which will allow mobile crews for sleeper replacement to be formed.

These crews will be equipped with:

- machines to replace sleepers
- 2 spike drivers
- 1 chain saw (for timber)
- 1 mechanical digger
- 1 small tamping machine (4th level)
- 1 lorry (for materials)
- 1 van (for the crew)

| Action | Purchase of 2 sets of equipment |
|---|---|
| Budget | 2 800 000 US$ |

### 8.11.5.3 Ballast Cleaner

The degradation of the ballast and pollution with sand make screening and cleaning the ballast indispensable. It is recommended that one high capacity ballast cleaning machine be purchased to carry out an annual work programme of about 100 km.

| Action | Purchase of a screener |
|---|---|
| Budget | 3 000 000 US$ |

### 8.11.5.4 Ballast Regulators

For generalised reballasting of the track and for levelling by heavy mechanised tamping, it is vital to acquire two ballast regulators which will allow the profile of the ballast to be improved.

| Action | Purchase of 2 ballast regulators |
|---|---|
| Budget | 1 660 000 US$ |

### 8.11.5.5 Ballast Wagons

TDY are lacking ballast wagons to carry out the ballast replacement programme, and provision is made in the investment plan for the purchase of 30 hopper ballast wagons, which will facilitate the distribution and spreading of ballast to the correct track profile.

| Action | Purchase of 30 hopper ballast wagons |
|---|---|
| Budget | 1 400 000 US$ |

### 8.11.6 Bridges

No investment on bridges is proposed. The two bridges indicated in paragraphs 8.9.2 and 8.9.3 are already in TDY's plans for reconstrucTION, WHILE THE MAJOR BRIDGe over the Amudariya river will be the subject of a separate study and investment programme.

## 8.12 Investment Summary

| Item | Unit (US$) | Qty | Cost (US $) |
|---|---|---|---|
| **A- Improvement of track components** | | | |
| Purchase of replacement Crossings | | | 400 000 |
| Assistance and training on resurfacing by welding | | | 100 000 |
| Concrete sleepers (to replace timber sleepers) | 28 | 500000 | 14 000 000 |
| Improvement of concrete sleepers factory | | | 1 000 000 |
| Improvement of ballast quarries | | | 1 000 000 |
| | | | |
| **B- Improvement of maintenance** | | | |
| Tools | | | 2 000 000 |
| | | | |
| **C- Mechanisation of the maintenance** | | | |
| Tamping machine | 1 750 000 | 4 | 7 000 000 |
| Equipment for a sleepers inserters gang | 1 400 000 | 2 | 2 800 000 |
| Ballast cleaner | 3 000 000 | 1 | 3 000 000 |
| Ballast regulators | 833 000 | 2 | 1 666 000 |
| | | | |
| **D-Bridges** | | | |
| | | | |
| **Total** | | | **34 360 000** |

# 9. Signalling And Telecommunications

## 9.1 Existing Situation Of Signalling

The Turkmenistan railway network consists of 2313 km lines 33 km of which is double-tracked.
About 1275 km lines are equipped with automatic block, the remaining with semi-automatic block systems. For automatic block sections, the distance between two stations is divided into 2.5 km sections. The railway line is equipped with 50 Hz track circuits. Out of the 171 stations, 142 are equipped with electrically controlled points.

There are 9 large stations and 23 medium ones. The average distance between them is about 10 - 15 km.

Most of the lines are operated through centralised electrically operated switches except in Krasnovodsk 1, Kala-i-Mor, Razezd 199 stations. These sections (Krasnovodsk 1, Kala-i-Mor, Razezd 199) are operated through route-controlling devices (without central management of switches).

On sections Dashrhowuz-Takhiatash-Kunyaurgench-Turkmenbashi, Gazodzodzhak-Cherdzhev, Cherdzhev-Mary, Mary-Dushak- Ashgabat, Ashgabat-Bami, Bami-Nebidag, Nebitdag-Krasnovodsk, Talimardzhan-Razezd 161 automatic block operates, with exception of sections Takhiatash-Kunyaurgench, Krasnovodsk 2-Giusha, Razezd 124-Razezd 124-Razezd 126, Aydin- Razezd 121. These sections are operated through semi - automatic block.
On the section Mary- Kushka semi - automatic block is operating.

On all sections of the network, with the exception of sections Mary-Kushka and Saparmurat Turkmenbashi-Serakhs, centralised dispatching is in place.

For detection of hot boxes in a moving train, 60 devices of non-contact detection of hot boxes are applied. There are 250 automatically equipped level crossings on the network; 53 level crossings are equipped with barriers, the rest of them are equipped with automatic warning signs and flashing lights signalling.

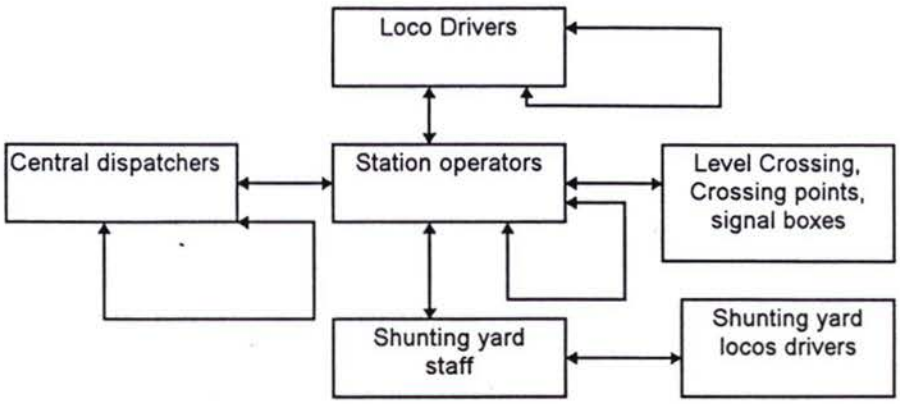
In stations and for automatic block and semi-automatic block installations, the equipment dates from the 1950s. Though their technology is obsolete, the equipment is rugged and easy to maintain. The equipment installed after 1978 can operate for many years yet.

There are two types of equipment in the Traffic Control Centre:

NEVA is the oldest (1970) and uses industrial relays to send and receive command and control information; some electronic circuits are used. The components are no longer manufactured and the only way to maintain the installations is to use the equipment parts which have been removed from other locations. After the next 5 years, a problem will arise when all spare parts presently available will have been used up.
LUCH is fitted with electronic boards and relays. It is still possible to buy spare parts for this system.

## 9.2 Existing Situation Of Telecommunications

Lines are equipped to enable the following types of communications to be made:




In Turkmenistan Railways pole and cable communication are applied. Cabled lines share is 40% of the total.
The section Dushak - Ashgabat is operated through a cable communication line equipped with a four times twelve channel analogus transmission system (instead of a pole line).
The section Dushak - Mary is operated through a pole line and a cable line. The cable communication line is equipped with a sixty channel analogus transmission system.
The sections Ashgabat-Turkmenbashy, Mary-Serakhs, Cherdzhev-Ashgabat, Cherdzhev-Amudaria, Ashgabat-Dashkhowuz are operated through long distance channels which are rented from the Ministry of Communication (due to a lack of its own railway channels).

Communication between trains drivers, station officers on duty and train dispatcher is established through train radio communication system; there are 171 fixed radio bases and 330 on-board radio equipment. All types of communication devices on the whole network, with exception of automatic telephone station in Cherdzhev, are 10 or more years old. In 1992 ,in Cherdzhev an electronic automatic telephone station was implemented. Electric centralisation, autoblocking, dispatching centralisation and communication devices are more than ten years old. The whole network offers a rate of one telephone line for 2.28 people.

The three different technologies of administrative telephones are distributed as below:

28% of Station-to-station (1970),
38% of Electromechanical (1980),
34% of Electronics (1990).

The transmission backbone is done through open wire lines. These have three major disadvantages :

- Open wire lines are no longer manufactured.
- These systems are noisy and subject to external disturbances
- They are limited in channel capacity and do not allow high speed data transmission.

All the multiplex for open wire line are of obsolete technology and are no longer manufactured; it is very difficult to find some spare parts.

For operating telephones, part of the equipment has been replaced by new equipment in the last five years, its technology being obsolete but reliable.

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

- the poor quality of the lines in some parts of the network,
- the difficulty to maintain the oldest installations.

## 9.3 Signalling And Telecommunication Maintenance

### 9.3.1 Organisation And Work Force

Maintenance operations are handled by « network maintenance areas » that are supervised by Regional Divisions who in turn report to the General Management.

Signalling and telecommunications are part of the same department. The whole staff amounts to 1790 persons ( 8. 5% of total railway staff ) which means 0. 77 person per km of line. The staff consists of: 9% engineers, 15% technicians, 76% operatives.

There are five Regional Divisions located at: Ashgabat, Amou - Daria, Tchardjoou, Mary, Turkmenbashy :

- The first one maintains installations from the Kizyl - Arvat zone to Douchak and has about 400 employees.
- The second one covers the Talimardjan region to passing station 16, with about 200 employees;
- The third one covers the Takhiatach, Farap and Outch - Adji region, with about 500 employees;
- The fourth one covers the Outch - Adji, Kouchka, Serakhs and Douchak region, with about 440 employees;
- The fifth one covers the Turkmenbashy to Kizil - Arvat region, with about 200 employees.

Each maintenance area team is composed of engineers, technicians and workers, and headed by a chief engineer. It is provided with track cars to transport equipment and personnel. Automobiles and motorcycles are also available to staff for commuting purposes.

### 9.3.2 Maintenance Budget

The estimate of the maintenance annual budget for 1996 (source TDY) amounts to 14,000 Million MANAT, about 2,7 Million US D.

It is broken down as follows:

| | | |
|---|---|---|
| • Salaries | 4 726 000 MANAT | i.e. 33,54% |
| • Costs and taxes | 2 362 000 MANAT | i.e. 16,77% |
| • Equipment and spares | 1 600 000 MANAT | i.e. 11,36% |
| • Energy expenses | 2 900 000 MANAT | i.e. 20,58% |
| • Structures and others | 2 500 000 MANAT | i.e. 17,75% |

This budget means 1,161 US D per km of line.

## 9.4 Incidents Observed In Operation Of Installations

The number of incidents recorded in 1996 was about 2000; precise statistics could not be obtained. Nevertheless, it can be said that these are due to three main causes :

- defective insulation of tracks generating track circuit incidents,
- unsatisfactory maintenance of installations due to the fact that they have been operated for a long time,
- defective equipment or parts due to their degree of wear.

The consequences of such incidents were, as an average, three hours delay. The total time lost due to these incidents is 6 000 hours per year. Through the investment and restructuring proposed the number of incidents would be decreased and their impact would be reduced, down to 1 800 hours per year.

## 9.5 Major Problems

The major obstacle to providing good maintenance conditions is the inadequate number of spare parts on hand, especially :
switch motors,
safety relays (especially for those dating from the 1950s) and
the availability of power supply batteries.

The second largest problem is the lack of tooling, small equipment and instrumentation needed to carry out repairs faster.

## 9.6 Measures Required To Improve Maintenance

To keep 70% of the installations in satisfactory operating condition for about fifteen years, it is necessary to supply the maintenance area teams with :

- any useful spare parts,
- small equipment,
- tooling,
- and instrumentation in sufficient quantity.

Details of the equipment are shown in the following table :

| DESCRIPTION | | AMOUNT $ |
|---|---|---|
| Capacitors, various types | | 120,000.00 |
| Resistors | | 10,000.00 |
| Transistors | | 150,000.00 |
| Diodes | | 10,000.00 |
| Printed circuits | | 100,000.00 |
| Lamps radio | | 30,000.00 |
| Instrumentation | | 50,000.00 |
| Tooling | | 30,000.00 |
| | **TOTAL** | **500,000.00** |

Whenever installations are renovated using equipment based on recent technology, staff training must be given priority.

## 9.7 Replacement Of Obsolete Installations

Through several interviews with technical managers of TDY a detailed list of investments was set together with their cost and priority. The following tables 1 and 2 show the items of equipment to be replaced, per line section , for signalling and telecommunications respectively, and the priorities assigned to them by TDY.

### 9.7.1 Signalling

Signalling proposals 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 : replaement of the Traffic Control Centre equipment.

These proposals were reviewed in order to give priority to those which :

- may affect sigmificantly the performance of railway operations,
- concern the most heavily trafficed sections

Table 1: TDY proposals for signalling

| n° | origin | destination | lg | description of investment | Cost | Priority |
|---|---|---|---|---|---|---|
| | turkmenbashi | | | Modernisation of blocks, centralising and signalling installations | 2 000 000 | 1 |
| 1 | turkmenbashi | nebit-dag | 155 | none | | |
| | nebit-dag | | | none | | |
| 2 | nebit-dag | kazandjik | 110 | none | | |
| | kazandjik | | | none | | |
| 3 | kazandjik | bami | 128 | none | | |
| | bami | | | Modernisation of blocks, centralising and signalling installations | 1 800 000 | 1 |
| 4 | bami | ashgabat | 166 | Modernisation of blocks, centralising and signalling installations | 5 500 000 | 1 |
| | ashgabat | | | Modernisation of blocks, centralising and signalling installations | 1 500 000 | 1 |
| 5 | ashgabat | dushak | 171 | none | | |
| | dushak | | | Modernisation of blocks, centralising and signalling installations | 414 000 | 2 |
| 6 | dushak | mary | 172 | Modernisation of blocks, centralising and signalling installations | 5 500 000 | 2 |
| | mary | | | Modernisation of blocks, centralising and signalling installations | 1 100 000 | 2 |
| 7 | mary | kyshka | 315 | none | | |
| | kyshka | | | none | | |
| 8 | mary | chardjou | 244 | Modernisation of blocks, centralising and signalling installations | 7 700 000 | 2 |
| | chardjou | | | Modernisation of blocks, centralising and signalling installations | 6 500 000 | 2 |
| 9 | chardjou | farab | 8 | none | | |
| | farab | | | none | | |
| 10 | chardjou | dargan-ata | 213 | none | | |
| | dargan-ata | | | none | | |
| 11 | dargan-ata | gaz-achak | 109 | none | | |
| | gaz-achak | | | none | | |
| 12 | siding449 | tahiatash | 71 | none | | |
| | tahiatash | | | none | | |
| | talimardjan | | | none | | |
| 13 | talimardjan | amudar'inskaya | 52 | none | | |
| | amudar'inskaya | | | none | | |
| 14 | amudar'inskaya | siding161 | 132 | none | | |
| | Tcharjou | Kerki | | Modernisation of blocks, centralising and signalling installations | 650 000 | 3 |

## 9.7.2 Telecommunication

The modernisation of telecommunication equipment concerns stations and sections. For review purposes those proposals which relate to module E of this project will not be taken into account, and items relating to fibre optic cabling will n ot be reviewed.

**TABLE 2 TDY proposals for Telecommunications**

| n° | origin | destination | lg | description of investment | cost | priorty |
|---|---|---|---|---|---|---|
| | turkmenbashi | | | Modernisation of telecommunications in station | 2900000 | 1 |
| 1 | turkmenbashi | nebit-dag | 155 | Modernisation of telecommunications using optic fibre | 6200000 | 2 |
| | nebit-dag | | | Modernisation of telecommunications in station | 400000 | 2 |
| 2 | nebit-dag | kazandjik | 110 | Modernisation of telecommunications using optic fibre | 460000 | 2 |
| | kazandjik | | | Modernisation of telecommunications in station | 400000 | 2 |
| 3 | kazandjik | bami | 128 | Modernisation of telecommunications using optic fibre | 5000000 | 2 |
| | bami | | | Modernisation of telecommunications in station | 400000 | 2 |
| 4 | bami | ashgabat | 166 | Modernisation of telecommunications using optic fibre | 6600000 | 2 |
| | ashgabat | | | Modernisation of telecommunications in station | 2900000 | 1 |
| 5 | ashgabat | dushak | 171 | Modernisation of telecommunications using optic fibre | 6900000 | 1 |
| | dushak | | | Modernisation of telecommunications in station | 400000 | 1 |
| 6 | dushak | mary | 172 | Modernisation of telecommunications using optic fibre | 6900000 | 1 |
| | mary | | | Modernisation of telecommunications in station | 400000 | 1 |
| 7 | mary | kyshka | 315 | none | | |
| | kyshka | | | none | | |
| 8 | mary | chardjou | 244 | Modernisation of telecommunications using optic fibre | 10300000 | 1 |
| | chardjou | | | Modernisation of telecommunications in station | 400000 | 1 |
| 9 | chardjou | farab | 8 | none | | |
| | farab | | | none | | |
| 10 | chardjou | dargan-ata | 213 | none | | |
| | dargan-ata | | | none | | |
| 11 | dargan-ata | gaz-achak | 109 | none | | |
| | gaz-achak | | | none | | |
| 12 | siding449 | tahiatash | 71 | none | | |
| | tahiatash | | | none | | |
| | talimardjan | | | Modernisation of telecommunications in station | 200000 | 3 |
| 13 | talimardjan | amudar'inskaya | 52 | Modernisation of telecommunications using optic fibre | 2120000 | 3 |
| | amudar'inskaya | | | Modernisation of telecommunications in station | 400000 | 3 |
| 14 | amudar'inskaya | siding161 | 132 | Modernisation of telecommunications using optic fibre | 5300000 | 3 |
| | Tcharjou | Kerki | | Modernisation of telecommunications using optic fibre | 8600000 | 2 |

## 9.8 Construction Of The New Line TCHARDJOU-KERKI

Of the 215 km of new track to be laid, 43 km have been completed. The railway plans to equip the line initially with semi-automatic colour light blocks, which can be replaced by automatic colour light blocks if traffic flows increase. The entire line will be managed by the Traffic Control Centre. The work has been stopped for lack of construction materials.

## 9.9 Electrification Project

Initiated by presidential decree in 1997, this project concerns the line divisions Bami - Ashgabat and Ashgabat - Douchak. The first line divisions to be electrified are Enev - Ashgabat and Ashgabat - Geokdepe, representing 35 km out of the 335 km covered by the project. According to the decree, this line section was supposed to start service in October 1998.

Now several decisions must be made to:

- select the electric power standards to implement,
- define what type of protection should be installed insofar as the signalling and telecommunication equipment is concerned,
- establish whether a new depot for electric-powered rolling stock should be built or the diesel depot should be adapted to electric traction, etc.

The Consultants have made an application to the TRACECA office of the EU in Brussels to authorise the drawing down of a further portion of the contingency fund of the Central Asian Railway Restructuring Contract to finance a small electrification study of the TDY proposal to be carried out early in 1998.

## 9.10 Investment Recommendations

### 9.10.1 Signalling Equipment

The priorities established in the TDY proposals on Table 1 are summarised as follows :

| | Priority | Amount |
|---|---|---|
| | 1 | 10,800,000.00 |
| | 2 | 21,214,000.00 |
| | 3 | 650,000.00 |
| | | |
| | **Total** | **32,664,000.00** |

Only first priority investments were studied, amounting to USD 10,800,000. These concerned:

- the Turkmenbashi, Bami and Ashgabat stations
- the installations between the Bami and Ashgabat stations.

As part of the project to electrify the Bami - Ashgabat and Ashgabat - Douchak line divisions, an additional study should be carried out to determine the type of protection to be provided on installations as well as the cost of supplying power to the catenary system. This study should cover the modernisation of signalling equipment at the Bami, Ashgabat and Dushak stations and between stations, i.e. between Bami and Ashgabat, and between Ashgabat and Dushak.

Therefore, the only top investment priority involves the modernisation of installations at the Turkmenbashi station (cost: USD 2,000,000). For two reasons, this investment should be made rapidly:

- obsolete technology
- much faster equipment corrosion due to the proximity of the sea, hence it is harder to ensure proper maintenance.

The modernisation of signalling installations in the station of Turkmenbashi will entail a 5% decrease in the signalling maintenance personnel of this regional division, i.e. 10 persons distributed as follows:

- 1 engineer,
- 2 technicians,
- 7 operatives

Downsizing effects from signal boxes reduction are to be studied in the part of the report devoted to operations.

On top of that, investments in spare parts, tools and instrumentation would significantly reduce the staff requirements through a productivity increase. Overall (without signal boxes reduction) the staff downsizing amount to 20% (360 staff).

Investment requirements may be summarised as follows:

First Year

- spare parts, tooling, instrumentation: 500,000 USD
- installations at the Turkmenbashi station: 1,000,000 USD

Second Year

- installations at the Turkmenbashi station: 1,000,000 USD

The total comes to : 2,500,000 USD

### 9.10.2 Telecommunications

The priorities established in the TDY proposals in Table 2 are summarised as follows :

| Priority | Amount |
|---|---|
| 1 | 31,100,000 |
| 2 | 32,200,000 |
| 3 | 8,020,000 |
| | |
| Total | 71,320,000 |

Special attention should be paid to two points:

- As in the case of the signalling equipment, the project to electrify the line divisions between Bami and Ashgabat and between Ashgabat and Dushak would lead to substantial modifications to protection of existing installations. These modifications and their cost will have to be based on a specific study within the project framework.
- Investment requirements will be based on the conclusions of Module E issued by the UIC.

ANNEX

There is however a need to replace some communications equipment as follows :

**1 Replacement of radio equipment :**

30 fixed base radios and 20 on-board equipments for train / dispatcher radio system (cables and
antennae included )
10 fixed base radios and 20 hand held radios for the shunting radio system
Estimated cost 300 000 $

**2 Modernisation of stations :**

Modernise the telecommunication installations in Bami, Dushak, and Mary
Estimated cost 1 200 000$

Total telecommunication investment required 1 500 000$

# 10. Rolling Stock

## 10.1 Introduction

The rolling stock of TDY is maintained by three separate departments:

Locomotive Services
Passenger Services
Wagon Services

The Heads of Locomotive Services and Wagon Services report to the First Deputy Director General. The Head of Passenger Services reports to the Director General.
Each department has its own separate depots and workshops.

## 10.2 Locomotives

### 10.2.1 Overview : Main Line Diesel Locomotives

The TDY main line fleet consists of 222 locomotives, of which 88 are currently available for traffic.

The age profile of the locomotives is as follows:-

| YEAR | 2TE 10L | 2TE10V | 2TE 10M | 2TE 10U | NOS. |
|---|---|---|---|---|---|
| 1970 | 30 | | | | 30 |
| 1971 | 56 | | | | 56 |
| 1972 | 13.5 | | | | 13.5 |
| 1973 | 38.5 | | | | 38.5 |
| 1974 | 12 | | | | 12 |
| 1975 | 5 | | | | 5 |
| 1976 | 11 | 3 | | | 14 |
| 1977 | 4 | | | | 4 |
| 1980 | | 1 | | | 1 |
| 1982 | | | 5 | | 5 |
| 1983 | | | 1 | | 1 |
| 1986 | | | 8 | | 8 |
| 1993 | | | | 33 | 33 |
| Total | 170 | 4 | 14 | 33 | 221 |

In addition there is one older type 2M62U locomotive.

The TRACECA Rolling Stock Maintenance Report July 1997 shows a fleet of 233 locomotives, but since then twelve of the older 2TE 10L locomotives have been scrapped. Operational locomotives have fallen from 120 to the current figure of 88, which is just short of operational requirements.

| TYPE | TOTAL | Condition | | | | Operating Daily Need |
|---|---|---|---|---|---|---|
| | | Parts | Factory repair | Depot repair | Serviceable | |
| 2M62U | 1 | - | - | - | 1 | |
| 2TE10L | 170 | 38 | 28.5 | 52.5 | 51 | |
| 2TE10V | 4 | - | 2 | - | 2 | |
| 2TE10M | 14 | - | 3 | 1 | 10 | |
| 2TE10U | 33 | - | 1.5 | 7.5 | 24 | |
| TOTAL | 222 | 38 | 35 | 61 | 88 | 95 |

The 2TE10 diesel-electric locomotives are 6000 hp and are all Russian built by Lugansk. A locomotive consists of two 3000 hp units permanently coupled back to back. The same two units always operate together throughout their life, and both have the same number. The series have gradually developed from 1966 (L series), 1975 (V series), 1979 (M series), and 1989 (U series). The locomotive horsepower has remained at 6000 hp, but tractive effort has been increased from 2x375 kn. to 2x399 kn. They are basically freight locomotives. Maximum speed is 100 kph, and bogies are the three axle CO-CO type with all axles motored. Axle loading 23 tonnes.

TDY, unlike some other CIS railways, do not differentiate between locomotives for freight operations and passenger operations. All main line locomotives operate as a pool.

It has not been possible to obtain reliability figures. The basic configuration of two units back to back means that the possibility of a complete failure in service is very much reduced. The drivers are trained to, and indeed undertake, running repairs in service.

The engines are the weak point of the locomotives, particularly the cooling systems. It is normal practice for TDY to remove the engines for attention at TR3 after only 180,000 km. Most of the locomotives are basic electro-mechanical units, which can be understood and adjusted by the drivers in the event of an on line failure. The later units with electronic components are more prone to cause on line failures, because they are more complicated and cannot be as readily dealt with by the crew, requiring more specialized skills.

The age profile is such that within the next five years another 100 locomotives will have exceeded their 30 year life, with a further 50 locomotives exceeding their life span within a further two years. The FSU regulations imposed a life limit, but as the locomotives are confined to Turkmenistan, TDY have the freedom to extend the life span if practicable. However there is a serious requirement for a major investment in new locomotives to start within the next five years.

TDY have looked at the possibility of extending the life of the locomotives by replacing the unreliable Kolomna engines in the older locomotives with General Electric power units, as has been done experimentally in Kazakhstan. However this proposal has been suspended pending consideration of electrification.

### 10.2.2 Overview : Shunting Locomotives

| YEAR | TEM2 | ChME3 | TOTAL |
|---|---|---|---|
| 1970 | 1 | | 1 |
| 1971 | 2 | | 2 |
| 1977 | 1 | | 1 |
| 1979 | 2 | | 2 |
| 1980 | 2 | | 2 |
| 1982 | | 24 | 24 |
| 1983 | | 41 | 41 |
| 1984 | | 5 | 5 |
| 1985 | | 10 | 10 |
| 1986 | | 1 | 1 |
| 1987 | | 6 | 6 |
| 1988 | | 1 | 1 |

| | | | |
|---|---|---|---|
| 1989 | | 1 | 1 |
| 1990 | | 1 | 1 |
| TOTAL | 8 | 90 | 98 |

Among the 98 shunting locomotives only 60 were in operation at the time of the TRACECA Rolling Stock Report, but currently 70 are operational.

| | TEM2 | ChME3 | TOTAL |
|---|---|---|---|
| FLEET SIZE | 8 | 90 | 98 |
| OPERATIONAL | 7 | 63 | 70 |

| TYPE | | Condition | | | | Operating Daily Need |
|---|---|---|---|---|---|---|
| | | Parts | Factory repair | Depot repair | Serviceable | |
| TEM2 | 8 | - | - | 1 | 7 | |
| ChME3 | 90 | - | 13 | 15 | 62 | |
| TOTAL | 98 | - | 13 | 16 | 69 | 72 |

The backbone of the shunting locomotive fleet is the diesel-electric Czech built CKD ChME3 single unit locomotives, which develop 1000 hp. The older single unit diesel electric TEM2 locomotives develop 1200 hp, and are more reliable.
The mechanical components of the ChME3 locomotives, particularly engines and air compressors, are unreliable.

## 10.3 Recommendations

### 10.3.1 Recommendations : Main line Diesel Locomotives

There are insufficient modern locomotives to meet the short term TRACECA fleet recommendation of 90 locomotives (180 units). This figure is in line with the proposed revised operating requirements for main line locomotives. Up to 40 locomotives need to be replaced within the next ten years, the majority being due for replacement in years 6-7.

The introduction of world market technology could considerably reduce operating costs, both by the use of re-engining in existing locomotives, and by the purchase of new locomotives.

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. The potential for cost reduction and life extension is examined in Subsection 11 of this section. It is recommended that a programme of conversion of ten locomotives should be started at the rate of two per year at a cost of $1.4m per locomotive. Due to greater availability 10 re-engined locomotives will replace 12 of the original design. Operational savings will produce an attractive pay-back period of less than three years.

The need to replace 40 locomotives could be reduced if modern world market single unit locomotives were considered for freight working. Improved reliability would far outweigh the advantage of double units, with much lower running and maintenance costs.

Joint ventures between Russian or Ukrainian locomotive manufacturers, and world market manufacturers, will probably produce the next generation of freight locomotives, but not before 1999. This is examined in Subsection 12. It is recommended that no freight locomotives of the existing design should be purchased, and no new freight locomotives are considered until the new designs have been proven in service. Provision of $24m is made for the initial purchase of eight new generation freight locomotives.

Replacing the 2TE10 locomotives with new generation 4000 hp locomotives of the same haulage capacity would give operational savings at least as great as re-engining, but with a longer pay back of 7 years.

### 10.3.2 Recommendations : Shunting Locomotives

The age profile shows that no investment in new shunting locomotives is required within the next ten years.

The number of operational shunting locomotives exceeds the recommended TRACECA short term requirements of 60 by 10. With the known unreliability of the ChME3 units the opportunity should be taken to re-introduce a programme of major overhauls.

Facilities should be provided to undertake the KR1 overhaul at Ashgabat works as well as the mainline locomotives.

## 10.4 Passenger Coaches

### 10.4.1 Overview : Passenger Coaches

The TDY fleet consists of :-

| Type | up to 10 yrs | 11-20 yrs | 21-30 yrs | over 30 yrs | TOTAL |
|---|---|---|---|---|---|
| Open - 54 seat/36 sleeper | 37 | 60 | 18 | - | 115 |
| Compartment - 36 sleeper | 27 | 6 | - | - | 33 |
| Air Conditioned -36 sleeper | 9 | 42 | 23 | 10 | 84 |
| A/C Train Lined - 36 sleeper | - | - | 11 | - | 11 |
| Obsolete | - | - | 7 | - | 7 |
| Ritz 18 seats and sleeper | 8 | - | - | - | 8 |
| Postal/Luggage | 3 | - | - | 2 | 5 |
| Restaurant cars | - | 8 | 5 | - | 13 |
| Diesel electric van | - | - | - | 2 | 2 |
| Technical | - | 1 | - | 3 | 4 |
| Inter regional 63 seats | 9 | 1 | 3 | 1 | 14 |
| Special (prison) | | | 4 | - | 4 |
| **Total** | 93 | 118 | 71 | 18 | 300 |

In addition to the above main line coaches there are 36 coaches for commuter services at Carjew. Between 18-20 of these are due to be scrapped. The two commuter services in Carjew to Farab and Seidi are maintained by Wagon Services.

The availability of the coaches at present is as follows :

| | |
|---|---|
| Passenger timetable | 166 |
| Spare | 68 |
| Maintenance | 26 |
| Works | 5 |
| Awaiting Works | 4 |
| CIS Overhaul | 12 |
| Technical etc. | 19 |

There are 15 new 61 seat coaches on order at present from DWB Ammendorf in Germany, due for delivery in early 1998.

### 10.4.2. Recommendations : Passenger Coaches

The condition of passenger coaches is not attractive to passengers as practically all maintenance funds are required to maintain the basic safety features of running the coaches.

It is recommended that coaches should have their passenger amenities upgraded by additional work on new interior surfaces, floor coverings, fabrics and fittings during DR. Materials will be required for this.

The average journey in TDY is around 300 km. Consideration should be given to conversion of sleeping coaches to seated coaches which would increase capacity.

## 10.5. Wagons

### 10.5.I. Overview : Freight Wagons

The wagon fleet is as follows:

FREIGHT WAGON FLEET

| | WAGON TYPE | TOTAL | | | REPAIRS | | AVAILABLE | AVERAGE REQUIREMENT |
|---|---|---|---|---|---|---|---|---|
| | | All CIS (incl. TDY) (incl. private) | Assigned TDY (67) | TDY (67) in Turkm. On 15th May 97 | All CIS (incl. TDY) | TDY (67) in Turkm. on 15th May 97 | All wagons | All wagons |
| | Covered | 3501 | 2283 | 2125 | 990 | 934 | 2422 | 2422 |
| | Tank | 3776 | 2309 | 1785 | 286 | 177 | 2266 | 2266 |
| | Flat | 3432 | 2662 | 2612 | 2718 | 2081 | 653 | 651 |
| | Open Top HS | 1869 | 1816 | 1577 | 234 | 308 | 1556 | 1558 |
| | Refrigerated | 608 | 562 | 542 | 4 | 4.... | 63 | 63 |
| | Others | 3346 | 1555 | 1432 | 421 | 349 | 2279 | 2277 |
| | TOTAL | 16532 | 11187 | 10073 | 4653 | 3853 | 9239 | 9237 |

Source: TDY Statistics Dept., except last column from Traffic Dept.
Exclude private wagons ( 2328 per TRACECA RS Report) from total = 14,532

The "Others" figure above contains the following specific wagons, for which the following figures are available:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Container Fl. | 806 | | | 98 | | 662 | 700 |
| | Grain Hopper | 460 | | | 23 | | 363 | 300 |
| | Cement | 699 | | | 13 | | 636 | 600 |
| | Side Dump | | | | | | | |

## 10.5.1 Contd.

The fleet of freight wagons in Turkmenistan do not all belong to TDY. There are 14,532 CIS wagons in total, of which only 11,187 are allocated to TDY. TDY makes use of the wagons belonging to other administrations to make up the number of wagons required daily, as there are insufficient number of TDY wagons in good repair to meet the demand.

The number of wagons available for traffic closely matches the numbers required. It thus appears that wagons are only made available as necessary.

The available wagons 9239, plus the wagons requiring repair 4,653, leaves a shortfall of 640 wagons on the all CIS total, which is largely accounted for by refrigerated wagons, which are not shown as repairable. Wagons outside CIS (Iran, Afghanistan etc.) are not accounted for, as well as wagons rented to other enterprises.

Out of the fleet of 10,073 TDY wagons in Turkmenistan on 15th May 1997, 3,853 were requiring repair. This means that to meet the average daily requirement of 9,237 wagons, 3,516 wagons belonging to other CIS railways were used, as follows:

| | AVERAGE DAILY REQUIREMENT | AVAILABLE TDY FLEET | AVAILABLE FROM OTHER CIS |
|---|---|---|---|
| Covered | 2422 | 1191 | 1231 |
| Tank | 2266 | 1608 | 658 |
| Flat | 651 | 531 | 120 |
| Open Top HS | 1558 | 1249 | 309 |
| Refrigerated | 63 | 59 | 4 |
| Others | 2277 | 1083 | 1194 |
| TOTAL | 9237 | 5721 | 3516 |

The number of wagons out of service is increasing. At the time of the TRACECA RS Report the position was:

| | | |
|---|---|---|
| All wagons : | 4,267 | (now 4,653) |
| TDY wagons only: | 2,564 | (now 3,853) |

It is not clear what the position is with the 524 Tank wagons assigned to TDY, but out of the country on 15th May 1997. According to Wagon Services all wagons allocated to TDY were received, except for 50 wagons in Russia.

To meet increases in traffic there are quantities of flat wagons which could be repaired. This has not been done due to an acute shortage of timber for decking. There is a general shortage of timber in Turkmenistan for wagon repairs.

| | AVERAGE REQUIREMENT | REPAIRABLE TDY FLEET | SHORTFALL | SURPLUS |
|---|---|---|---|---|
| Covered | 2422 | 934 | 297 | 0 |
| Tank | 2266 | 177 | 481 | 0 |
| Flat | 651 | 120 | 0 | 1961 |
| Open Top HS | 1558 | 308 | 1 | 0 |
| Refrigerated | 63 | 4 | 0 | n/a |
| Others | 2277 | 349 | 845 | 0 |
| TOTAL | 9237 | 3853 | 1624 | 1961+Refrig. |

The age profile of the fleet is as follows:

| Age at 1/5/97 | up to 10 yrs | 10 - 20 yrs | 20 - 30 yrs | over 30 yrs | TOTAL |
|---|---|---|---|---|---|
| | 1661 | 3538 | 4007 | 1981 | 11187 |

### 10.5.2 Recommendations : Freight Wagons

To reduce dependence on other railways to meet the current needs, and eliminate demurrage charges, there is a requirement in the short term to overhaul 1400 wagons - 934 Covered wagons, 308 Open Top HS wagons, and 177 tank wagons. 1400 at $10,000 each
- i.e. $ 14m. This arrears of maintenance cannot be considered for capital investment.

The age profile of the wagon fleet is such that a replacement programme should be started. However the wagon condition is such that it is considered that there is no need to commence a replacement programme at present if the life of the wagons can be extended.

The obstacle to this are the CIS regulations which place an absolute limit on the life of a wagon irrespective of its usage and condition. Every effort should be made to have the regulations changed so that suitable wagons can be repaired and kept in service.

## 10.6. Locomotive Depots And Workshops

### 10.6.1 Overview : Depots and Workshops

There are four main locomotive running depots on TDY, with sub depots, at which drivers are based, reporting as follows

Gazanjik
- sub depot: Turkmenbasy (end of line)

Ashgabat

Mary
- sub depots: Gusgy: (border with Afghanistan)
- sub depot: Sarahs: (border with Iran)

Carjew 1
- sub depot: Carjew 2 (other station)
- sub depot: Dashowuz: (isolated section beyond Kazakhstan)
- sub depot: Amudariya: (isolated section between Kazakhstan/Afghanistan)

There is in addition a Locomotive Works in Ashgabat which undertakes all TR3 maintenance on main line locomotives. It is administered together with the Running Depot, although it is on a different site.

### 10.6.2 Overview : Locomotive Maintenance

Maintenance procedures of TDY are as follows:

| | |
|---|---|
| TO1 | Inspection by driver (daily) |
| TO2 | Inspection and lubrication in depot (every 3 days) |
| TO3 | Depot check - engine, elect brushes, etc.<br>(2TE10 - every 17 days or 7200 km).<br>(ChME3 - every 30 days). |
| TR1 | Depot repair - fuel injection, turbocharger, clean motors etc.<br>(2TE10 - every 2.3 months or 29,000 km).<br>(ChME3 - every 7.5 months). |
| TR3 | Depot repair - remove bogies, engine 2TE10<br>(2TE10 - every 18 months or 180,000 km).<br>(ChME3 - every 2 5 years). |
| KR1 | Major overhaul<br>(2TE10 - every 4.5 years or 680,000 km).<br>(ChME3 - every 7.5 years). |
| KR2 | Major overhaul<br>(2TE10 - every 9 years or 1,360,000 km).<br>(ChME3 - every 15 years). |

There is no central CIS control of locomotive maintenance, unlike freight wagons and passenger coaches, where regulations are tightly controlled and updated centrally. Each railway can now set standards of its own, subject to Transport Ministry approval.

TDY have eliminated the TR2 repair for budget reasons, and have reduced the TR3 repair interval from 220,000 km to 180,000 km.. A TR3 repair costs around US$ 37,000.

Although the maintenance intervals may be based on kilometres or time, invariably it is the time base which is used, as the locomotives average 80,000 km per annum. However, overall locomotives fleet average is 36,000 km per annum. This leads to much more maintenance being carried out than is necessary.

Maintenance is carried out at the depots as follows:

| | TO2 | TO3 | TR1 | TR3 |
|---|---|---|---|---|
| Turkmenbasi | * | * | * | |
| Gazanjik | * | * | * | * |
| Ashgabat Depot | * | * | * | |
| Ashgabat Works | | | | * |
| Mary | * | * | * | |
| Sarahs | * | * | * | |
| Gugsby | * | | | |
| Carjew 1 | * | * | * | * |
| Carjew 2 | * | | | |
| Dashowuz | * | | | |
| Amundaria | * | | | |

All TR3 overhauls to 2TE10 mainline locomotives are carried out at Ashgabat works, except by special dispensation when a TR1 repair at Gazanjik or Carjew is so extensive that it is re-designated as TR3. TR3 overhauls to shunting locomotives are carried out at Gazanjik or Carjew.

Only work at Sarahs is to 1435 mm gauge locomotives.

### 10.6.3 Overview : Major Overhauls

TDY does not undertake any major overhauls KR1 (5 years ) or KR2 (10 years ) to locomotives themselves.

Locomotives are sent to Tashkent or Russia for major overhauls. A KR1 for a 2TE10 is reported to cost $260.000 per loco, and must be paid in hard currency

MAJOR OVERHAUL RECORD

| | Main Line | | Shunting | |
|---|---|---|---|---|
| Year | Plan | Actual | Plan | Actual |
| 1993 | 63 | 33 | 92 | 13 |
| 1994 | 40 | 0 | 79 | 0 |
| 1995 | 57 | 0 | 80 | 0 |
| 1996 | 81 | 0 | 81 | 0 |
| 1997 | 85 | 0 | 85 | 0 |

Major Overhauls are well behind schedule , but locomotives are kept going by additional intermediate repairs.

As well as the 85 main line locomotives currently behind schedule for KR overhaul, the 33 overhauled in 1993 will become due again in 1998, totalling 118.

In addition there are 85 shunting locomotives currently overdue KR, which will increase to 86 by 1998.

Only US$ 1.5m has been allocated next year for this work, which will barely cover 3.5% of the required expenditure to clear the backlog on the current fleet (US$ 30.5m for main line and US$ 13m for shunters).

In addition to the backlog around US$ 6.7m will be required every year just to carry out the KR on a reduced fleet of 90 main line locomotives ($5.5m) and 60 shunting locomotives ($1.2m), if the work continues to be sent abroad.

### 10.6.4 Recommendations : Locomotive Depots and Workshops

All major overhauls presently carried out in other CIS countries should be undertaken in Turkmenistan. Ashgabat Works has the skilled staff capable of undertaking KR overhauls, and the existing working areas could be re-organised to provide the space required.

The main principle should be to have the capability for the complete assembly/dis-assembly of locomotives, with stocks held of re-conditioned components for unit exchange.

There is no need to have the capability to completely overhaul every part in house.
Specialised repairs such as overhaul of generators, traction motor armatures, etc. would still need to be undertaken abroad. These major units should be available on a unit exchange basis, with spare units held in store at all times.

The work should only be undertaken if a satisfactory stock of spare parts is held, and stock levels are kept high enough to avoid any interruption to the work flow. A stockholding of around US$ 2 m of parts will be required.

Facilities required for KR1 are as follows:

- Hydraulic press for wheel-sets
- Axle lathe
- Vertical boring mill
- Tyre shrinking equipment
- Jigs and stands for engine overhaul
- Jigs and stands for engine component overhaul
- Machine tool replacement programme

Costs for KR1 facilities at Ashgabat Locomotive Depot are estimated at US$ 4m for equipment and for workshop changes.
Of the $6.7m annually required to be spent abroad for major repairs, mark-ups of 100% are mentioned because of lack of competition. If TDY could reduce the cost of major overhauls by $ 3m by being able to carry out the work themselves, the above expenditure could be justified.

Ashgabat Works should be set up as a separate locomotive repair business unit separate from the running maintenance of locomotives. There is no need for any other location.
All TR3 overhauls of both main line and shunting locomotives should be centred on the works. Specialised units should be set up and exchange components supplied to all depots.

Other locations outside Ashgabat are required mainly for operational reasons.
Running maintenance depots should be kept purely to suit operational requirements, with running maintenance transferred accordingly. This would retain depots at Turkmenbasy, Ashgabat and Carjew as bases for drivers, locomotives and running maintenance up to TR1, and Gazanjik and Mary as bases for drivers only. There is sufficient capacity for the maintenance work to be transferred to a smaller number of depots.

The sub depot at Gusgy should close, and closure is already planned for Carjew 2.
Sub depots would be retained at Dashouwuz and Amundaria for the time being, with the latter closing when the new line is completed. The sub-depot at Sarahs should report to Ashgabat.

Gazanjik and Mary could be eventually closed when increased operating speeds are introduced.

Inspections ( TO1 drivers daily inspection, TO2 three day inspection over pit, TO3 seventeen day or 7500 km inspection and component check) and running maintenance (TR1 - 2.3 monthly or 29,000 km servicing of engine, electrical machines brakes etc.) should all be carried out wherever the locomotive is relocated.

One under-floor wheel lathe is sufficient to meet the needs of TDY for regular wheel turning. This programme should be based on the lathe at Ashgabat depot. The under-floor lathe at Carjew depot should be kept in good working order as a reserve.

Generally depots are structurally in reasonable condition, but annually $0.2 m should be allowed for general maintenance, structural repairs, power and lighting improvements.

## 10.7 Passenger Coach Depots

### 10.7.1 Overview : Passenger Coach Workshops

The maintenance of all passenger coaches on TDY is carried out as an integral part of the Passenger Services Division. All maintenance is carried out at a central workshop and depot in Ashgabat, except for running maintenance on commuter coaches based in Carjew, which is carried out by Carjew Freight Wagon Depot.

The Ashgabat Passenger Coach Depot prepares and makes up train sets for operation, washes trains, carries out TO2 and TO3 running maintenance examinations.

The adjoining works carries out the annual DR overhaul of all TDY passenger coaches, plus the 40 commuter coaches at Carjew.

TO1 examinations are carried out prior to the commencement of a journey and at turn round points.

There are no facilities in Turkmenistan to undertake major overhauls (KR1 - 5 years) or capital repairs (KR2 - 20 years). Coaches are sent to plants in Ukraine or Kazakhstan for this work. A KR1 in Ukraine currently costs US$ 29,000.

### 10.7.2 Overview : Passenger Coach Maintenance

Maintenance procedures of TDY for coaches are as follows:

| | |
|---|---|
| TO1 | Inspection during train preparation |
| TO2 | Seasonal Preparation - summer/winter (6 monthly) |
| TO3 | Technical Inspection (annual) |
| TR | Unscheduled Running Repair |
| DR | Depot Repair (annual) |
| KR1 | Major Overhaul (5 years) |
| KR2 | Major Overhaul (20 years) |

The above maintenance procedure is laid down by the CIS Council of Railway Administration in Moscow. TDY must adhere to the agreed standards, as coaches travel over international borders.

Maintenance is purely time based. There is no alternative of kilometre based maintenance.

### 10.7.3 Recommendations : Passenger Coach Depots

The works at Ashgabat should be upgraded to undertake KR1 Major Repairs.
The staff have the necessary skills. There is sufficient space available to set up the additional facilities.

The work should only be undertaken if a satisfactory stock of spare parts is held, and stock levels are kept high enough to avoid any interruption to the work flow. A stockholding of around US$ 1.0 m will be required to be held at all times.
Parts requirements should be forecast in detail 12 months in advance, and the forecast reviewed at 3 monthly intervals.

Improvements are 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 $ 2m.

Maintenance procedures for passenger coaches are still strictly regulated through the CIS Council of Railway Administration. It is consequently unlikely that one country could deviate from the laid down requirements, because of the control of coach condition at border crossings. However, the possible move to kilometre based passenger coach maintenance from time based maintenance should be pursued.

## 10.8 Freight Wagon Depots And Works

### 10.8.1. Overview

The TDY freight wagon fleet is maintained by four depots along the main line, each depot being responsible for running maintenance of wagons in a section of the line, as well as on other lines in their area:-

| | |
|---|---|
| Turkmenbashi (Krasnavodsk) | Turkmenbashi - Bamy |
| Ashgabat | Bamy - Dusak |
| Mary | Dusak - Ucajy |
| Carjew | Ucajy - Dashhowuz |

In addition there is a main workshop at Gyzlarbat with no running maintenance responsibilities. Major overhaul (KR)of wagons is carried out mainly at Gyzylarbat, but also at Carjew and Turkmenbashi.

There are Technical Examination Units (TEU) based all along the lines at places where freight trains stop, or wagons are attached or detached, reporting back to their respective depots. For example, between Bamy and Dusak (336 km) there are eleven points where staff are based, who report back to the Ashgabat depot.

Each depot has facilities for Depot Repair (DR), except Ashgabat, which has no covered facilities and must send wheel-sets to Ashgabat Passenger Depot. Gyzlarbat Works undertakes Depot Repairs as well as Major Repair (KR).

No freight wagons are sent to other countries for Major Repair (KR).

### 10.8.2 Wagon Maintenance

Maintenance is carried out as follows:

| | |
|---|---|
| TO | Inspection in traffic. |
| TR1 | Running Repair. |
| TR2 | Running Repair in Depot |
| DR | Depot Repair (every year-tanks and open top; 2 years others) |
| KR1 | Major Overhaul every 8-12 years, depending on wagon type. (Refrigerators only - every 5 years) |

The above is the new maintenance procedure adopted by the CIS Council of Railway Administration in Moscow this year. Temporarily DR repairs have been extended to 14 months on an experimental basis to reduce costs.
TDY must adhere to the agreed standards, but if wagons for internal traffic are segregated, they may be exceeded. Maintenance appears to be excessive, as it is based on time elapsed, with no provision for maintenance based on condition or on kilometres covered.

There is a proposal by the CIS Commission of Wagon Service Specialists to further change the DR repair from time based to 100,000 km (i.e. equivalent to 1 to 1.5 years for an operational wagon with normal operation). This should be adopted before the end of the year by the CIS Council at their next meeting.

Maximum wagon life by CIS regulations is 30 years (average, depending on type of wagon, but acid tanks wagons, for example, have a life of 16 years) ), which means that no wagon older than the limit can go to another CIS country.

Bogie frames also have a 30 year maximum life - the date is cast in.

The central wagon control computer in Moscow still operates, logging all wagon data - age, mileage, location etc. All wagons must stop for maintenance at the appropriate time, except for internal use. There is special dispensation to complete journeys for wagons already loaded.

### 10.8.3 Recommendations : Wagon Depots and Works

All DR depot repairs, as well as KR major overhauls, should be concentrated on Gyzlarbat Works in the east and Carjew Depot in the north west. The other depots should be reduced to concentrate on the running aspects of wagons, with in service failures dealt with by unit exchange, including wheel-sets, and sent to the above depots for repair.

The specialised parts of the above depots for repairs of air brake components, wheel-sets and bearings, couplers and draft gear, should be set up as separate units. This is in line with the TRACECA Rolling Stock Report recommendation for component reconditioning to be carried out by 4th level independent units.

The repair of tank wagons should be concentrated at Gyzlarbat, and the works expanded to provide the specialised facilities.

Maintenance procedures for wagons are still strictly regulated through the CIS Council of Railway Administration. It is consequently unlikely that one country could deviate from the laid down requirements because of the control of wagon condition at border crossings. However, the possible move to km. based wagon maintenance from time based maintenance should be pursued.

In addition changes in the present centrally applied CIS rules are essential if major investment in new wagons by TDY is to be deferred. The life assigned to both wagons and bogie frames is conservative and could be extended by 5-10 years. This should be pursued.

The need to have wagons examined at frequent intervals should be reviewed. TDY stop and examine wagons every 150 km, whereas European practice is to examine wagons only as the commencement of the journey.

## 10.9 Investment Plan Summary

| INVESTMENTS US$ million | TOTAL | FIVE YEAR PLAN 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 10-Re-engined 2TE10 locos | 14.0 | 2.8 | 4.2 | 4.2 | 2.8 | - |
| 8-New freight locomotives | 24.0 | - | 6.0 | 6.0 | 6.0 | 6.0 |
| Upgrade loco workshops | 4.0 | 2.0 | 2.0 | - | - | - |
| Upgrade coach workshops | 2.0 | 1.0 | 1.0 | - | - | - |
| Upgrade wagon workshops | 4.0 | 1.0 | 1.5 | 1.5 | - | - |
| Spares Stock | 3.0 | 1.5 | 1.5 | - | - | - |
| TOTAL | 51.0 | 8.3 | 16.2 | 11.7 | 8.8 | 6.0 |

## 10. 10 Spare Parts

In addition the TRACECA Rolling Stock Report recommends an urgent investment in spare parts of US$ 4m which is mainly required for consumable spares on current repairs. It is agreed that this amount is of the right magnitude.

As well as political considerations, there are genuine logistics reasons for the desire to be self sufficient in spare parts supply. To obtain any quantity of spares requiring hard currency, high level government approval is required for every transaction, no matter how small. The supply system in CIS does not appear to have adapted to meeting customer requirements, and having parts available for sale to support products, rather than producing parts as directed for distribution to a central plan. TDY does not appear to have a central purchasing facility, putting the burden on user departments to obtain supplies. This may be an area where the EC could provide assistance in formulating buyer/seller relationships.

There are considerable quantities of spare units lying around all works and depots. These should be documented and considered for factory unit exchange before investing in new equipment.

## 10.11 Technical And Financial Analysis Of The Replacement Of The Te10 Engine By A Ge Power Pack

This analysis is based on a study the Consultant has made on the technical and financial aspects of modification to replace fifty 2TE10 locomotives for KTZ. The figures have been adjusted to show the financial effects of modification to replace a fleet of twelve locomotives for TDY.

This modification consist of replacing the diesel engine and auxiliary equipment by GE components (including diesel engine, generator, air compressor, cooling system ).

The following assumptions have been made:

1. Due to the age profile of the fleet, TDY would have to select locomotives which are 20 years old, with electrical systems in good condition and overdue KR2.
2. TDY will make a KR2 during the modification and replace the traction motors, wheels, etc.
3. The replacement equipment should add 5-8 years to the life of the locomotives.

Considering that the replacement of the engine will add about 5 years to the life span of locomotives with 10 years life left, the effects were studied over 15 years.

**Analysis of Maintenance and Unscheduled Repairs**

The figures are based on data from KTZ. It is assumed that data for the same locomotives operated by TDY would be the similar, except that TDY do not carry out the TR2 repair, and costs of KR will be higher as they are contracted out.

During a 15 year period, the maintenance operations, number of unscheduled repairs and the resulting downtimes will have a significant impact.

## 10.11.1 TE10 Engine

The following analysis gives the total maintenance and unscheduled repair costs for a TE10 locomotive unit (i.e. half a locomotive).

| **Assumptions** | |
|---|---|
| Km/year | 110000 |
| Hours run/year | 3000 |
| | |
| | |

| **Maintenance Repairs** | | | | | | |
|---|---|---|---|---|---|---|
| Maintenance operation | T03 | TR1 | TR2 | TR3 | KR | TOTAL |
| No of repairs for 15 years | 270 | 62 | 11 | 8 | 3 | |
| Average downtime per repair (h) | 24.8 | 50.1 | 238 | 298 | 502 | |
| Total downtime for 15 years (h) | 6696 | 3106.2 | 2618 | 2384 | 1506 | 16310 |
| Average downtime per year (h) | 446.4 | 207.08 | 174.5 | 158.9 | 100.4 | 1087 |
| Cost per repair ($) | 285 | 950 | 20130 | 49875 | 66500 | |
| Total cost for 15 years ($) | 76950 | 58900 | 221430 | 399000 | 199500 | 955,780 |
| Average cost for 1 year ($) | 5130 | 3926.7 | 14762 | 26600 | 13300 | 63,718 |

| **Unscheduled Repairs** | |
|---|---|
| No UR per 1.000.000km | 95 |
| Average downtime per UR (h) | 115 |
| No UR/year | 10.5 |
| UR downtime per year (h) | 1201.75 |
| Total cost for 15 years=Maintenance cost ($) | 955,780 |
| Average cost for 1 year=Maintenance cost ($) | 63,718 |

| **Total cost for Maintenance and Unscheduled Repairs for 15 years ($)** | 1,911,560 |
|---|---|
| **Average cost for Maintenance and Unscheduled Repairs 1 year ($)** | 127,437 |

| ***Availability Rate (%)*** | 73.9 |
|---|---|

### 10.11.2 TE10 Modified With A GE Engine

| **Assumptions** | |
|---|---|
| Km/year | 110000 |
| Hours/year | 3000 |
| Labour cost/hour ($) | 5 |

| Maintenance operation | 1/92 days | 1/year | 1/2 years | 1/3 years | 1/4 years | KR | Total |
|---|---|---|---|---|---|---|---|
| No of repairs for 15 years | 29 | 13 | 6 | 4 | 2 | 1 | |
| Average downtime per repair | 1.5 | 1.3 | 4.8 | 2 | 0.5 | 30 | |
| Total downtime for 15 years (h) | 43.5 | 16.9 | 28.8 | 8 | 1 | 30 | 128.2 |
| Average downtime for 1 year (h) | 2.9 | 1.1 | 1.92 | 0.5 | 0.067 | 2 | 8.5 |
| Cost per repair ($) | 39 | 31.7 | 121.3 | 10 | 5 | 1745 | |
| Materials costs per repair (excluding oil) ($) | 879 | 50 | 1691.6 | 0 | 60 | 38419 | |
| Total cost per repair ($) | 918 | 81.7 | 1812.9 | 10 | 65 | 40164 | |
| Total cost for 15 years ($) | 26622 | 1062.1 | 10877.4 | 40 | 130 | 40164 | 78,895 |
| Average cost for 1 year ($) | 1774.8 | 70.8 | 725.16 | 2.7 | 8.7 | 2677.6 | 5,259 |

| **Unscheduled Repairs** | |
|---|---|
| Average downtime per repair (h) | 8 |
| No UR/year | 1 |
| UR downtime/year (h) | 8 |
| Material costs for 1 year ($) | 800 |
| Total cost for 1 year ($) | 840 |
| Total cost for UR for 15 years ($) | 12,600 |

| **Total cost for Maintenance and Unscheduled Repair for 15 years ($)** | 91,496 |
|---|---|
| **Average cost for Maintenance and Unscheduled Repairs for 1 year ($)** | 6100 |

| ***Theorical Availability Rate (%)*** | 99.8 |
|---|---|

In this study, the time taken for the locomotives to be returned to their depots is not taken into account.

We have taken that the cost of unscheduled repairs as the same as the cost of maintenance repair. Usually, we consider that this cost is 10% higher.

The availability rate of 74% for the TE10 given by KTZ should be decreased in our opinion to about 70%.

The theoretical availability rate of 99.8% for the modified locomotives is too high. In fact, the remaining equipment of the TE10 (traction motors, bogies, brake system, etc.) comprising 20% of unscheduled repairs, should impose a decrease of this ratio to about 90%.

Consequently, the difference of the two ratios, about 20%, should allow a corresponding reduction in the number of locomotive units to be replaced.

**Analysis of Fuel oil and Lubricating oil costs.**

| Assumptions | |
|---|---|
| Cost of 1 tonne of fuel oil ($) | 150 |
| Cost of 1 tonne of lubricating oil ($) | 500 |

**Fuel oil**

| | Russian Engine | GE Engine |
|---|---|---|
| Tonnes/loco for 1 year | 934 | 533 |
| Tonnes/loco for 15 years | 14010 | 7995 |
| Cost for 1 year ($) | 140100 | 79950 |
| Cost for 15 years ($) | 2,101,500 | 1,199,250 |

This data given by KTZ can be verified by the following calculation;
- the total fuel consumption per year is about 4.4 M tonnes
- the number of locomotives is about 500
- the cost of 1 tonne of fuel is about $150

The result is about 800 tonnes per locomotive and per year.

The difference in consumption per engine is quite marked, but if we made a calculation using the following ratios (given 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 |
| Cost for 1 year ($) | 262,500 | 201,600 |
| Cost for 15 years ($) | 3,930,000 | 3,024,000 |

**Lubricating oil**

| | Russian Engine | GE Engine |
|---|---|---|
| K/loco (t) for 1 year | 10.96 | 5 |
| K/locos for 15 years (t) | 164.40 | 60.0 |
| Cost for 1 year ($) | 5480 | 2500 |
| Cost for 15 years($) | 82,200 | 37,500 |

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/loco for 15 years (t) | 1050 | 105 |
| Cost for 1 year (M$) | 35000 | 3500 |
| Cost for 15 years (M$) | 525,000 | 52,500 |

**Total running costs**

Assuming the same operations, 12 2TE10 locomotives can be replaced by 10 modified 2TE10 locomotives, due to the greater availability.

The proposed investment plan using 10 modified locomotives, compared to 12 2TE10 locomotives, is as follows.

| | TE10 Loco | | Modified Loco | |
|---|---|---|---|---|
| | 1 Year | 15 Years | 1 Year | 15 Years |
| Maintenance and unscheduled repair costs for 1 engine unit ($) | 127,438 | 1,911,560 | 7,000 | 91,496 |
| Fuel oil for 1 engine unit ($) | 140,100 | 2,101,500 | 79,950 | 1,199,250 |
| Lubricating oil for 1 engine unit($) | 5,480 | 82,200 | 2,500 | 37,500 |
| **TOTAL COSTS I ENGINE UNIT($)** | **273,018** | **4,095,260** | **89,450** | **1,328,245** |
| **TOTAL 12 EQUIVALENT LOCOMOTIVES(M$)** | **6.55** | **98.29** | **1.79** | **26.56** |
| **Savings (M$)** | | | **4.76** | **71.73** |

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 unscheduled repair costs for 1 engine unit ($) | 127,438 | 1,911,560 | 6,100 | 91,500 |
| Fuel oil for 1 engine unit ($) | 262,500 | 3,930,000 | 201,600 | 3,024,000 |
| Lubricating oil for 1 engine unit($) | 35,000 | 525,000 | 3,500 | 52,500 |
| **TOTAL COSTS I ENGINE UNIT($)** | **424,938** | **6,366,560** | **211,200** | **3,168,000** |
| **TOTAL 12 EQUIVALENT LOCOMOTIVES(M$)** | **10.20** | **152.8** | **4.22** | **63.36** |
| **Savings (M$)** | | | **5.98** | **89.17** |

The savings per year with the ratios are $ 5.98 million in place of $ 4.76 million.

***Cost of the modification***

| **Assumption** | |
|---|---|
| labour cost / hour ($) | 5 |

| | |
|---|---|
| Cost of 1 engine set GE equipment ($) | 650,000 |
| Transport cost of 1 set GE equip ($) | 24,000 |
| Modification time/ 1 engine (man-hours) | 2,000 |
| Modification cost/ 1 engine ($) | 10,000 |
| TOTAL 1engine | 682,000 |
| TOTAL 20 engines | 13,640,000 |
| Tools ($) | 400,000 |
| **Total cost ($)** | **14,040,000** |

The total modification cost for 10 locomotives to replace 12 2TE10 locomotives will be about $14 million, compared to the $ 4.76 million savings per year on the running costs.

These calculations show that if the modifications are done in one year, the investment could be paid in 2.9 years (2.3 years with the ratios).

These locomotives should be in operation until 2015. Consideration could then be given to transferring the equipment to younger locomotives.

## 10.12 Developments In World Market Locomotive Technology.

World-wide competition between motive power suppliers has led to the development of quality equipment with high reliability and availability for service coupled with minimum maintenance needs.

Modern locomotives, incorporating the latest developments in diesel engine and transmission technology, require less maintenance than units of out-dated design. The immediate effect of this is that when purchasing replacement units the number of spare units needed to cover for maintenance and repair is lower for the new units. It is possible to readily achieve fleet availability levels of over 95% in early years of service, and later, when the maintenance pattern of the fleet has stabilised into its regular pattern, for heavy repair and overhaul, availability up to 90% is achievable.

There has been extensive research in the field of power and control electronics for diesel motive power. The use of modern power and control electronics facilitates the control of the generator and traction motor currents without the use of the highly rated resistors needed by the older systems thereby saving energy and fuel.

The control flexibility of power electronics enables electric rheostatic braking to be continuously blended with the air braking, to apply full braking effort to the locomotive while minimising the use of the air brake, with a saving on the wear and tear to the brake rigging and the brake blocks.

One of the critical parameters in diesel locomotive design, especially for freight traffic, is the adhesive weight of the unit. The locomotive adhesive weight on any network determines the maximum trailing load of train that can be operated on the system. When the trailing load is too great for the wheel-to-rail adhesion conditions prevailing the locomotive wheels slip, the wheels may suffer damage and the train may not move. With up-to-date electronics it has become possible to detect and correct this slipping so quickly that the effective adhesion is increased by up to 50%. In practice this means that single locomotives can operate heavy trains that formerly required two locomotives.

The diesel engines have been developed to a stage where major intervention for maintenance is seldom needed before 1.0 M kilometres of service. The engines are more durable and this reflects itself in the lower consumption of spare parts which contributes significantly to lower maintenance costs.

The net effect of all the developments, as outlined above, is that it is now possible to buy fewer locomotives when replacing existing units. Depending on the general operating pattern of the railway one new locomotive can replace two or more old units.

General Motors are developing a prototype AC traction locomotive of 4000 hp under a joint venture agreement with Ljudinovo Locomotive Works in Russia. Two eight axle locomotives are being manufactured at the Russian plant. This locomotive, TERA1 (RE meaning Russian and American) should be capable of hauling 4500t (the average train weight is about 3000t) on a gradient of 9°/00 ($\gamma$=0,33 compare to 0,22 of a TE10). The speed limit will be 115 km/h. The locomotive is designed for a life of 35 years. One locomotive would be the equivalent of a two unit 2TE 10 locomotive. Production should start in 1999 at a cost of M$3.

In addition, General Motors have also signed a memo of understanding for the inclusion of ac traction and microprocessor controls in a proposed heavy haul prototype which would be built jointly with Lugansk Locomotive Works, Ukraine.

GE Transportation Systems, in partnership with Adtranz, have signed a letter of intent with the Russian Ministry of Transportation to place an order for the recently developed "Blue Tiger" series of modular locomotives. Again this locomotive will replace two unit locomotives of existing design and technology.

# 11. Management Information Systems

## 11.1 Introduction

### 11.1.1

Turkmenistan Railways (TDY) employ approximately 21,300 staff and carries 7.25 million passengers annually, as well as 8 million tonnes of freight each year.

### 11.1.2

The Management of the railway is to undergo a period of significant change resulting from a major restructuring exercise in line with other Central Asian Railways and government policies. The present management information systems will be inadequate to enable decisions to be made by management in a changing market economy.

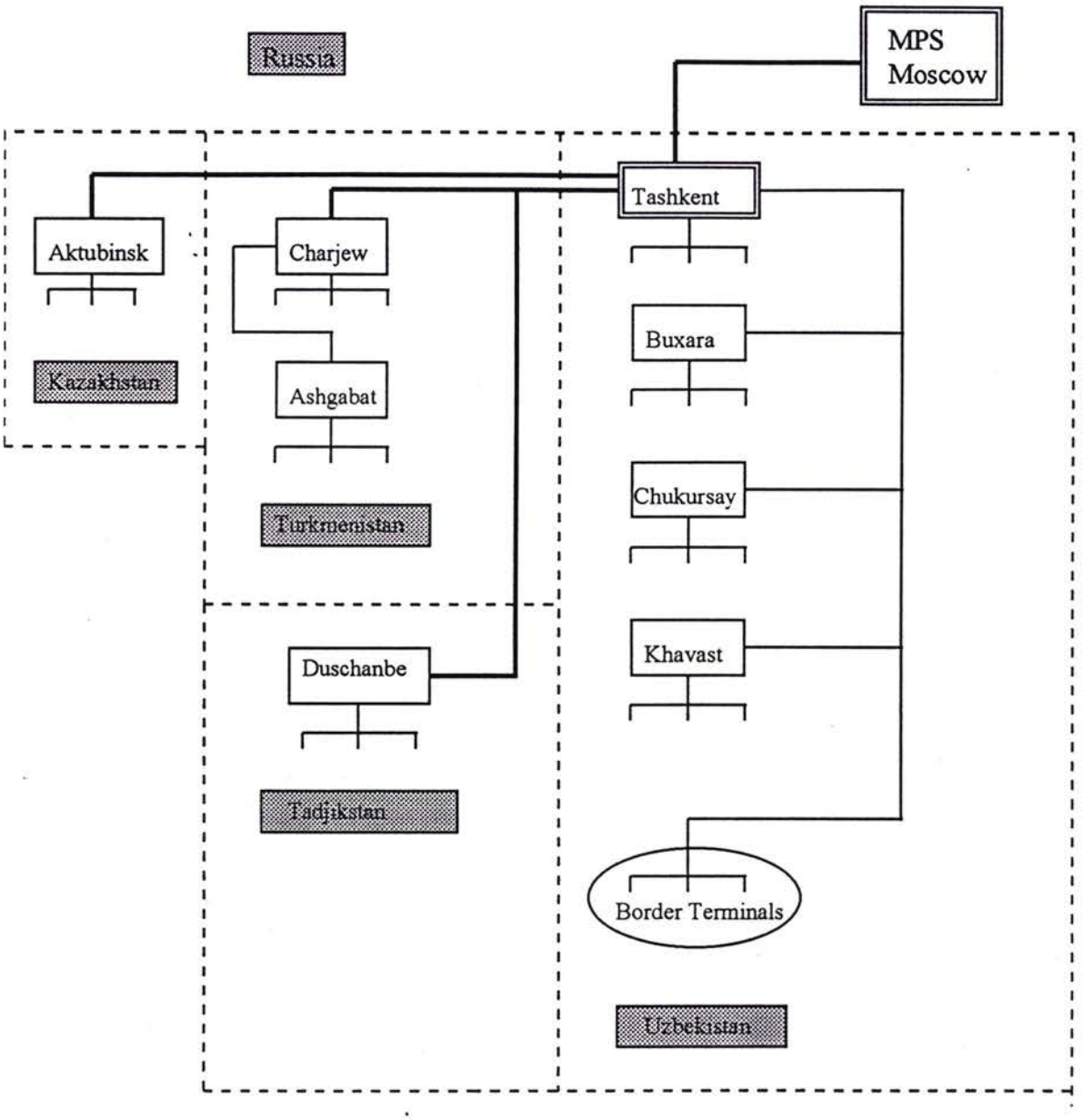
### 11.1.3

From a management point of view it is intended that the railway activities are to be divided up into various Business Units and it will be imperative to ensure that adequate financial and other information is available timely and accurately.

## 11.2. Existing Management Information Systems

### 11.2.1 M.I.S. Structure

Dating from the previous Soviet times, computing for Central Asian countries, including Turkmenistan, was centralised at a large computer centre employing 300 people in Tashkent, Uzbekistan and connected to MPS in Moscow. As a consequence, the Turkmenistan computing centre is based away from the main Ashgabat headquarters in Charjew and all data is channelled through the latter centre for the purpose of processing a number of traffic related operations. See the following diagram:




Main link to Moscow 2400 bps

Domestic links 1200 bps

Terminals

Main Computer Centres

National Borders

The present information system which was designed in the 1970's is based on IBM compatible equipment and Charjew houses a dual processor IBM 4381 machine where some 70 staff are employed. The system comprises mainly of two components and uses an independent slow speed network (1200 bps) :-

ASOUP : a freight train information system
DISKOR : a freight wagon information system

The consignment note for each shipment is used to create a data base of relevant detail.
Additional information concerning loading/unloading, routes and train composition are also entered.

All data are provided from freight stations, shippers and freight reporting points situated at approximately 150 kilometres along track routes.

Data are centralised at Tashkent, some is sent to the MPS Moscow system, and results processed for redistribution and unsolicited enquiry at the various stations and headquarters in Ashgabat.

The only management departments to be connected to the system are the centralised train control responsible for freight traffic, who ensure data validity and the statistics department who estimate daily traffic flow volumes

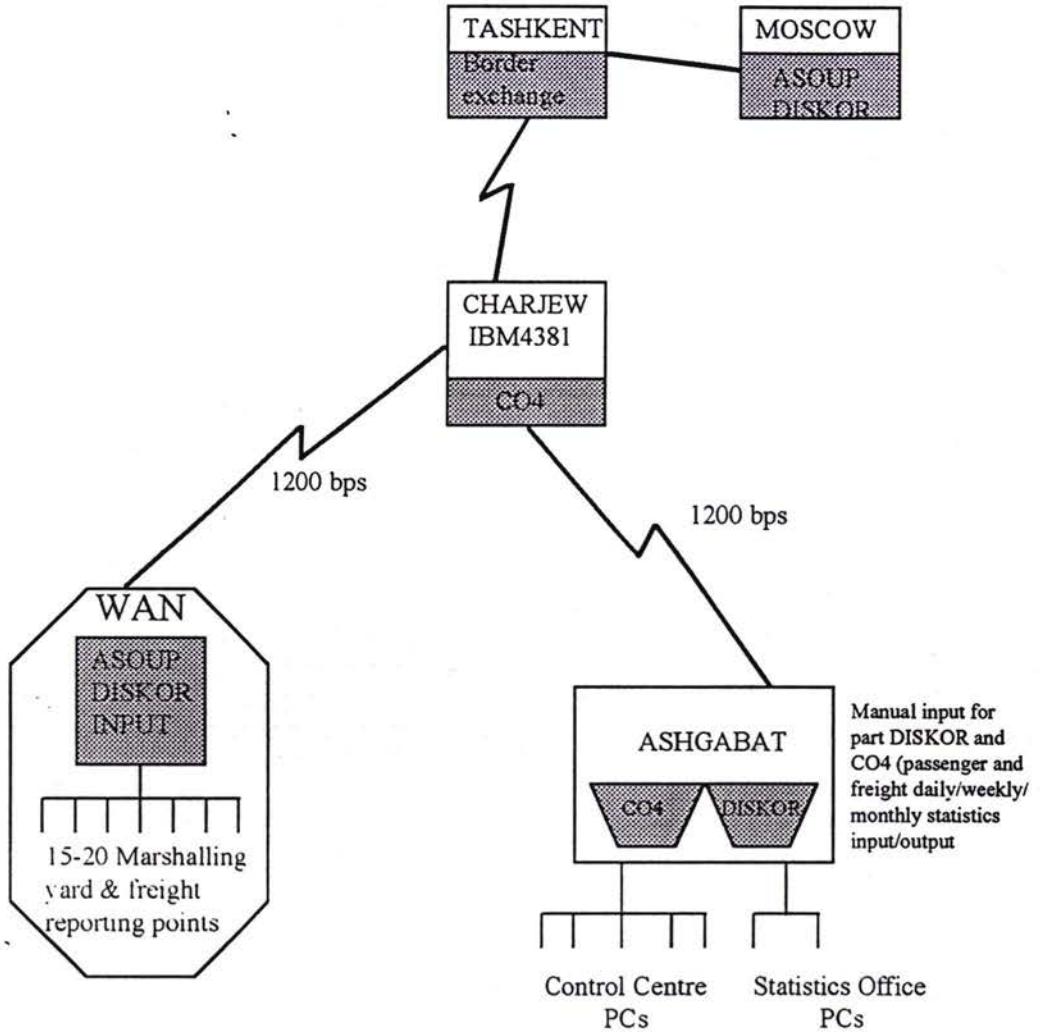
ASOUP and DISKOR work on-line with Moscow. They provide access to a data base containing train specific information such as train number, loading, commodity carried, consignee, origin and destination station, wagon tracking, train composition and train planning data including both wagon and locomotive utilisation and demurrage penalties.

A third and domestic module is that known as CO4, an application which produces traffic statistics concerning freight tonne kilometres and numbers of passengers travelled. The data for this system are input over a separate telecommunications network from Ashgabat after manually produced documentation from all stations is collated there.

### 11.2.2 Architecture

The architecture of these systems is illustrated below:-

Diagram 2




Aside from a very small number of PC office applications, there are no other automated information systems although it is likely that EXPRESS2 terminals will be acquired for some stations in the near future and connected to Moscow to provide automatic ticket issuing and revenue accounting, all of which is presently manually performed.

### 11.2.3 Hardware

Present hardware comprises of one dual processor IBM 4381 at the computer centre at Charjew which was acquired second hand in 1995

Local computers in Ashgabat comprise of about 25 PC's including seven on line for the Freight information system and the remainder in various departments very much under utilised through lack of training, for office applications.

### 11.2.4 Communications

The transmission backbone is made up of two types of transmission links namely copper buried cable and open wire on pole. The open wire makes up 78% of the total transmission links whilst the

remaining 520 km of sections of line are equipped with buried cables supporting multiplex systems and audio - frequency systems. 60 channel K 60-P systems are used

The open wire line systems have been discontinued world wide and in any event they are generally noisy, subject to external disturbances, limited in channel capacity and will not support high speed data transmission. The multiplex for open wire is of obsolete technology rendering the supply of spare parts impossible.

### 11.2.5 Conclusions

The first conclusion to be drawn is that due to the past political and financial circumstance, the Turkmenistan Railway has not developed a sufficiently strong computing culture. This needs quickly rectifying if successful management information systems are to be developed.
The proliferation of PC's and training in their use is essential and urgent particularly in the headquarters departments.

The CIS Railways Transport Council for OSGD countries is currently defining and developing new standards for cross border regulation information exchange and every opportunity should be taken to exploit the data that will become available to provide additional traffic information.

A good quality telecommunication network is an essential pre-requisite to any management information system. Unfortunately, the TDY current system is old, of obsolete hardware and incapable of quality high speed data transmission. This must be rectified as a matter of urgency.

Currently, little exists in the way of automated information systems but in the effort to build new systems to meet the management requirement aligned to a changing market economy, that which does exist should not be dispensed with. The present systems, which provide traffic information, should be enhanced and built on leaving those areas where nothing exists to be concentrated on for priority in new systems building. Everything will not be achieved at once and a piece by piece approach with a total strategy in mind is essential.

In modern market economies supplies and demands constantly and quickly change and management needs to respond to such change in a way that will protect their own business and profits. This situation requires accurate and timely financial information for all levels of management and it is considered that TDY first concentrate in the financial area in starting to build their comprehensive and integrated management information systems.

## 11.3. Planning For Future MIS Requirements

### 11.3.1 General Considerations

There are three basic issues to consider :

- Establishing a central computer centre
- What to do about any existing systems
- Increasing the functional coverage into a fully integrated MIS system

#### 11.3.1.1. A Central Computer Centre

Since plans are already well advanced to move the present centre from Charjew to Ashgabat and assuming the necessary telecommunication facilities are to be made available , then it is sound policy to implement the plan as soon as possible. To have the operation and administrative control of the railway at the same location will help to foster a common computing culture which is currently lacking.

#### 11.3.1.2. Existing Systems (ASOUP, DISKOR and CO4)

It might be regarded that weaknesses of the present systems are that they rely on obsolete telecommunications technology, although that can be remedied, and secondly there is a total dependency on MPS in Moscow for both operation and development of the applications. However, with the formation of the OSGD group of Central Asian countries mentioned earlier, some control over ongoing development etc. is now possible. Further, the MPS in Moscow are currently both enhancing the systems functional ability and changing over to new hardware which will give better reliability.

All of this together with the fact that the TDY headquarters functional departments, who rely on the information produced by these systems, have expressed an 'in principle' satisfaction with the scope and quality of information received suggest that these systems should be allowed to continue as part of the future system. This will allow priority to be given to the development of new systems.

It is also desirable for traffic information purposes where large numbers of trains cross national borders that joint development and use of technically or operationally oriented software systems are utilised since there is considerable common culture including the use of the Russian language.

#### 11.3.1.3. Increasing the Functional Coverage

The present functional coverage of automated management information is confined to the traffic movement area and if TDY management is to operate effectively in the future with its remodelled structure then much more accurate and timely information is required in all functions to enable correct operational and financial decisions to be made.

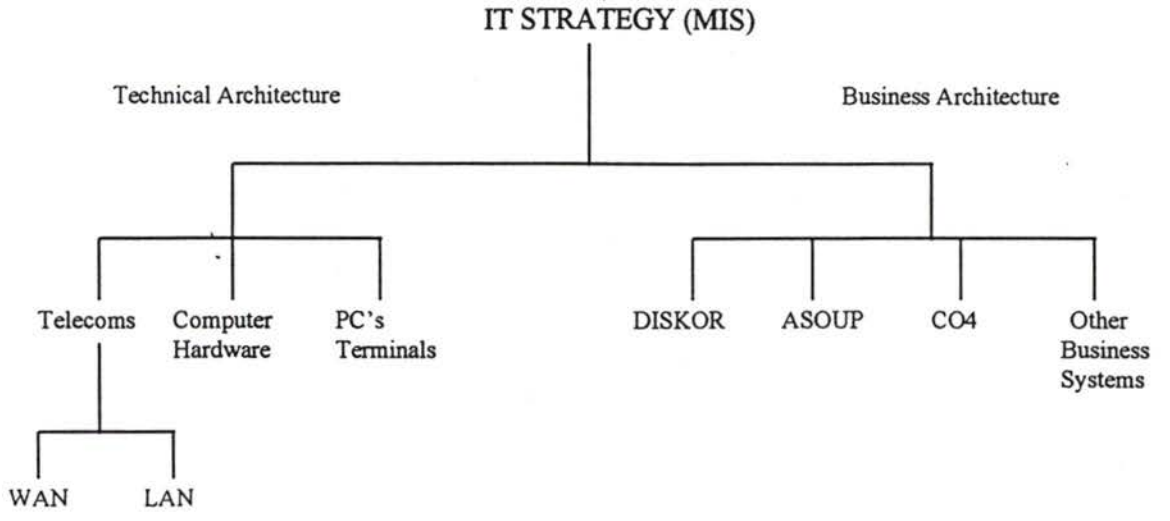
However, an important point to note is that functional systems should not be developed in isolation from the corporate need. All basic data should be collected once only, stored in a corporate data base and then processed to meet the needs of the various levels of functional management. This ensures that all information is based on the same data with a common interpretation.

The remainder of this section sets out a strategy to be followed in building a comprehensive management information and recommends priorities to be followed in its development. The higher priority systems are dealt with in more detail than others and can serve as a guide for subsequent systems development.

### 11.3.2 System Design Requirements

#### 11.3.2.1. Overall Strategy for MIS

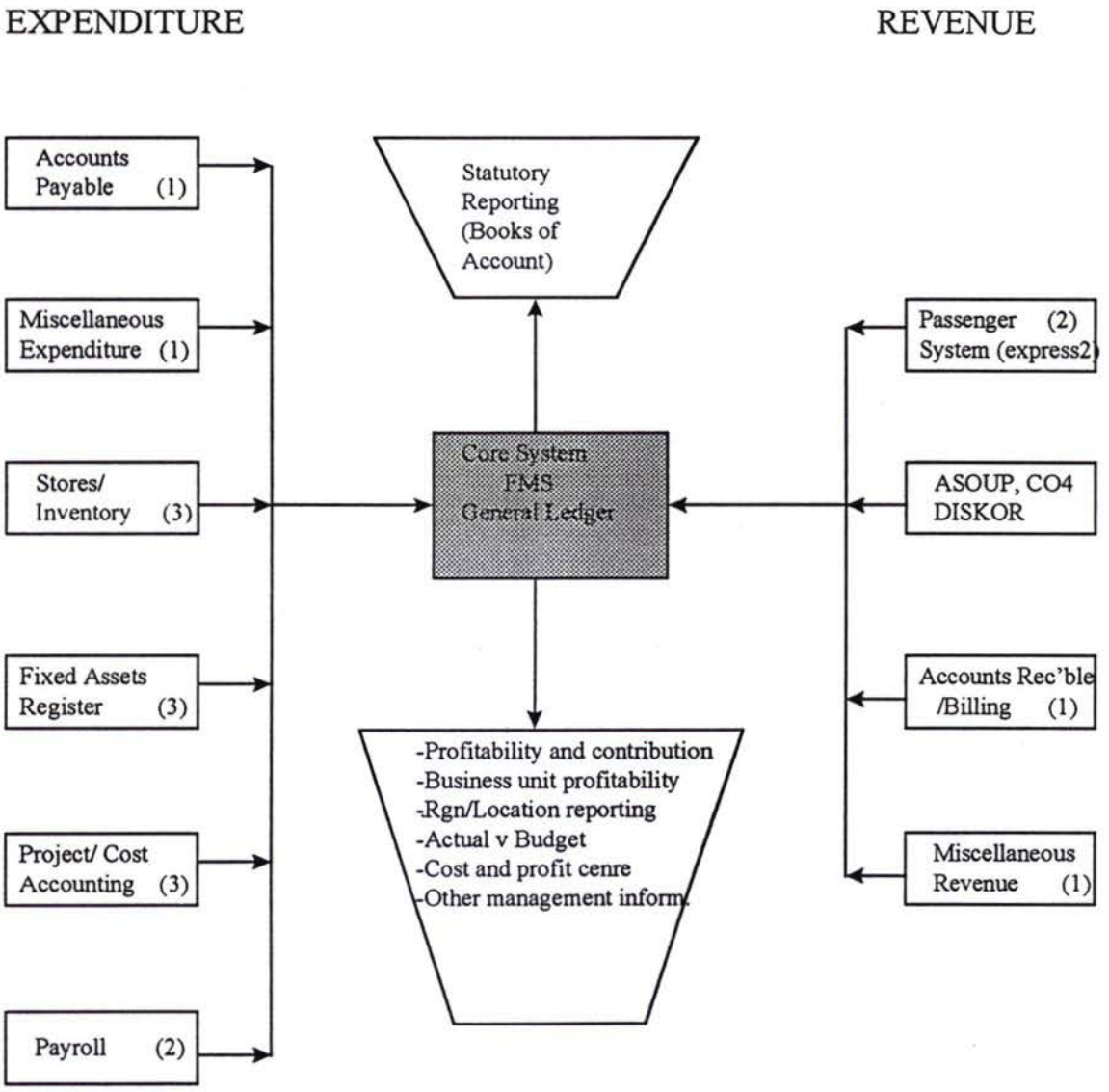
The overall structure of the MIS strategy can be represented as shown in the following diagram :-




The concept is to develop new modules in a priority order and ensure interface is possible with existing systems which are to be retained and align them with the business needs. All systems, manual or automated will need to automatically interface with the core system, a financial management system.

The following diagram presents a representation of how the Financial Management System forms the 'core' system of an ultimately fully integrated MIS system. The interfaces shown between the FMS system and the existing Expenditure and Revenue Systems can be electronic or manual dependent upon the present level of computerisation of each one. Eventually, of course, it is the aim to build new systems for each area which will automatically interface with the FMS. The suggested priorities of such future developments are indicated and the overall MIS can be represented as below:-

# MANAGEMENT INFORMATION SYSTEM CONCEPT



#### 11.3.2.2. Systems Architecture - Software

The MIS architecture should comply with open system standards thus avoiding the need to be tied to a single hardware manufacturer, protect against rapid obsolescence and ensure inter operability of all future systems.

The following standards of conformity should apply :-

- The application programs should be independent of the technical platform on which they are deployed.
- The application components should be developed in a modular fashion to facilitate easy amendment to suit differing functional requirements, enabling core logic to be retained unaltered.
- Two way interfaces should be provided to permit industry standard document exchange and support OLE in order to exploit spreadsheets and word processing etc. facilities.
- Standard programming development tools should be used for on going ease of maintenance.

#### 11.3.2.3. Systems Architecture - Hardware

- Processors should conform to the latest RISC technologies and incorporate pipe-line and multi-simultaneous instruction despatch.
- In cabinet upgrades should be possible to at least twice the original specified performance.
- Should include hot standby facility or software fault tolerant standby with minimum change over time (effectively 99% availability or less than I hour per year).
- Guaranteed performance under TPC-A standard
- RAID set hot swapable disks without system loss.

#### 11.3.2.4. Systems Architecture - Telecommunications

The need for new infrastructure is obvious, however to date, no detailed studies have been carried out to indicate the technical choices, timing and magnitude of such an investment. TDY does have the following factors in its favour in considering renewal:-

- The right of way covers all relevant parts of the country and therefore cable can be laid along track relatively inexpensively.
- Most of the existing infrastructure is totally obsolete and therefore a complete freedom of choice exists in making technical choices for the future.

The first point above is to be addressed as part of this study by the U.I.C. and should result in a comparison of technical choices, timing and sizing of the future investment.

For the purposes of the MIS investment cost details shown in section 11.4 of this report, the costs specified in the TACIS Infrastructure Maintenance 2 project are quoted.

### 11.3.3. The Core FMS System

#### 11.3.3.1. Objectives

The objectives of the Financial Management System are to:-

- Produce meaningful financial analysis
- Provide a complete set of accounts
- Be of flexible design to enable inter-face with other both Manual and Computer systems.
- To provide inter-face financial data for costing analysis and Management Accounting information systems.

### 11.3.3.2. Basic Principles

The general ledger will form the central data base of the railway and will store data at the lowest level, and be consolidated at summarised levels, from different accounting models and subsystems. This information will be used to :-

- Prepare statutory financial statements in accordance with the prevailing accounting regulations.
- Prepare internal management reports to support the existing management structure.
- Compare and report actual results against budget results.
- Prepare business and service unit profitability statements (i.e. Passenger, Freight, Infrastructure etc.).

The general ledger will thus hold all financial data and other selected non-financial data to enable the production of relevant reports and information.

### 11.3.3.3. Scope of FMS

The FMS should include the following modules:-

- General Ledger
- Accounts payable
- Accounts receivable and billing
- Miscellaneous income and expenditure
- Budgeting

The following modules should not be covered in the initial FMS specification

- Fixed assets
- stores and inventory
- project accounting/job costing

These modules are regarded as lower level priority and should be integrated as part of the FMS at a later stage.

### 11.3.3.4 Impact on the Organisation

There will be a number of new task areas to be implemented for the FMS. The principal new tasks areas are as follows:-

- Extract data from feeder systems and input to the FMS
- Carry out regular FMS data processing routines
- Maintaining fixed data on the FMS
- Prepare TDY management report package, including interpretation and commentary.

These task areas will need to be broken down into individual activities, but this analysis cannot be completed until the FMS software has been selected and the operating requirements of the new software clearly understood. This is a task for the TDY project team which will need to be established to manage the implementation of the FMS.

In addition to the new task areas, the workload associated with current task areas will also be affected by the introduction of the FMS. For example, the data from which reports will be produced will be largely derived automatically by the FMS with limited manual intervention. However, for these reports to provide useful information to management, they will require detailed interpretation and commentary. Accordingly, the organisation will need to be adjusted at implementation time.

### 11.3.3.5. Training

The analysis of the training needs will depend ultimately on the system (software and hardware) which is selected in support of the FMS. However, any tender documentation which is prepared for the system should consider aspects related to training focused on :-

- Needs for the TDY project team members
- Users of the system
- Operational running tasks
- Data base administration
- Use of report writers
- Use of the development tools

The possible sources of training have been identified and can be classified as external training providers, consultants working on the restructuring study, and TDY staff (who will be trained by the trainers).

In order to optimise the effort and to involve TDY staff in an active way, the strategy of "train the trainers" should be adopted. A small number of TDY finance and economic staff will first be trained and they then will train the remainder of the staff.

However, it should be noted that FMS impinges on all parts of the organisation, which means that users will need to understand how the system can be used to support their day to day management and operational activities.

A typical training needs analysis matrix for the FMS follows :-

Training needs analysis for the FMS

| **Training** | **Required by (level)** | **Possible Providers** |
|---|---|---|
| 1. FMS concepts | • Directors<br>• Senior Managers<br>• Accounting<br>• Economics | • Consultants external<br>• Senior Finance Managers TDY |
| 2. Computer skills<br>• Basic<br>• Intermediate<br>• Advance | • Accounting staff<br>• Economics | • Suppliers of hardware and software |
| 3. Computer skills<br>• Network<br>• Distributor processing | • System administrators<br>• Accounting<br>• Economics | • Suppliers of software and hardware |
| 4. Project Management | • For TDY personnel given responsibility for implementation of MIS and hardware systems. | • External consultants<br>• Hardware suppliers |
| 5. General Ledger | • Accounting<br>• Economics<br>• Computer / IT sections ("Train the trainers") | • Software suppliers<br>• Other external consultants |

| Training | Required by (level) | Possible Providers |
|---|---|---|
| 6. Accounts Payable | • Accounting<br>• Economics and Planning<br>• Computer / IT sections ("Train the trainers") | • Software suppliers<br>• Other external consultants |
| 7. Accounts Receivable | • Accounting<br>• Economics<br>• Computer / IT sections ("Train the trainers") | • Software suppliers<br>• Other external consultants |
| 8. Budgeting and Planning | • Accounting<br>• Economics<br>• Computer / IT sections ("Train the trainers") | • Software suppliers<br>• Other external consultants |
| 9. Financial Management Activities | | |
| 9.1 Budgeting and Planing | • Accounting<br>• Economics<br>• Business Managers | • External Financial Management consultants. |
| 9.2 Funds Management (Treasury) | • Chief Accountant and Senior Managers<br>• Chief Accountants<br>• Business Managers | • Treasury specialists |
| 9.3 Capital Investment | • All managers (financial and non-financial) involved in the capital investment cycle. | • External FM consultant with transport experience in appraising projects. |
| 9.4 Traffic Costing | • Economics<br>• Accounting<br>• Commercial and marketing units. | • Specialist traffic costing consultant |

### 11.3.4. Other systems Development

#### 11.3.4.1. Payroll and Personnel Management

The principle involved in a payroll system is fairly obvious from its title and it is not proposed to enter into detail. However TDY is badly lacking in other aspects of a personnel management system. Data on promotions, benefits, salaries, changes in grade, job specifications, clothing and personal details are currently being laboriously written and stored manually.

It is suggested that some simple PC based package should be purchased to ease the load in this area before embarking on a more integrated comprehensive payroll and personnel management system, which should be attempted as a second priority item.

#### 11.3.4.2. Passenger Information System

As mentioned earlier in this report, it would make sense for TDY to join into the Russian system and purchase some EXPRESS2 terminals for reservations, ticket issuing, revenue accounting and general passenger statistics. Should these terminals not cover all stations or trains then it would be appropriate to purchase some intelligent stand alone ticket issuing machines and the data captured by them should be integrated with that from the main system.

#### 11.3.4.3. Fixed Assets

A fixed assets system is an essential sub module of the FMS and care should be taken in selecting the main FMS software package to ensure that a fixed assets module is available. When integrated into the main system, it will enable TDY to keep an updated register of all depreciable assets. It is suggested that this task be undertaken as third line priority.

#### 11.3.4.4. Project Costing/Accounting

As in the case of fixed assets, project costing/accounting is a sub module of the main FMS. It will enable TDY to account easily and separately for each of its ongoing projects and provide a very useful management tool for project managers of all functions.

#### 11.3.4.5. Stores and Inventory

A Stores and Inventory control system is a major task to specify and implement. There are, however, many software packages available, including those developed by a number of European Railways, which could be adapted to meet TDY needs. Such a project will be similar in effort and timescale to that of the main FMS system and should not be attempted until the remainder of the information systems are in place.

## 11.3.5. Project Approach

### 11.3.5.1. Primary Work Stages

The implementation of the FMS should be undertaken by a specially set up team of both external experts and TDY staff, the former reducing as progress is made and TDY staff are trained. The intention should be not to try and do everything at once and therefore a small but relevant area should be chosen in which to implement the system on a pilot basis.

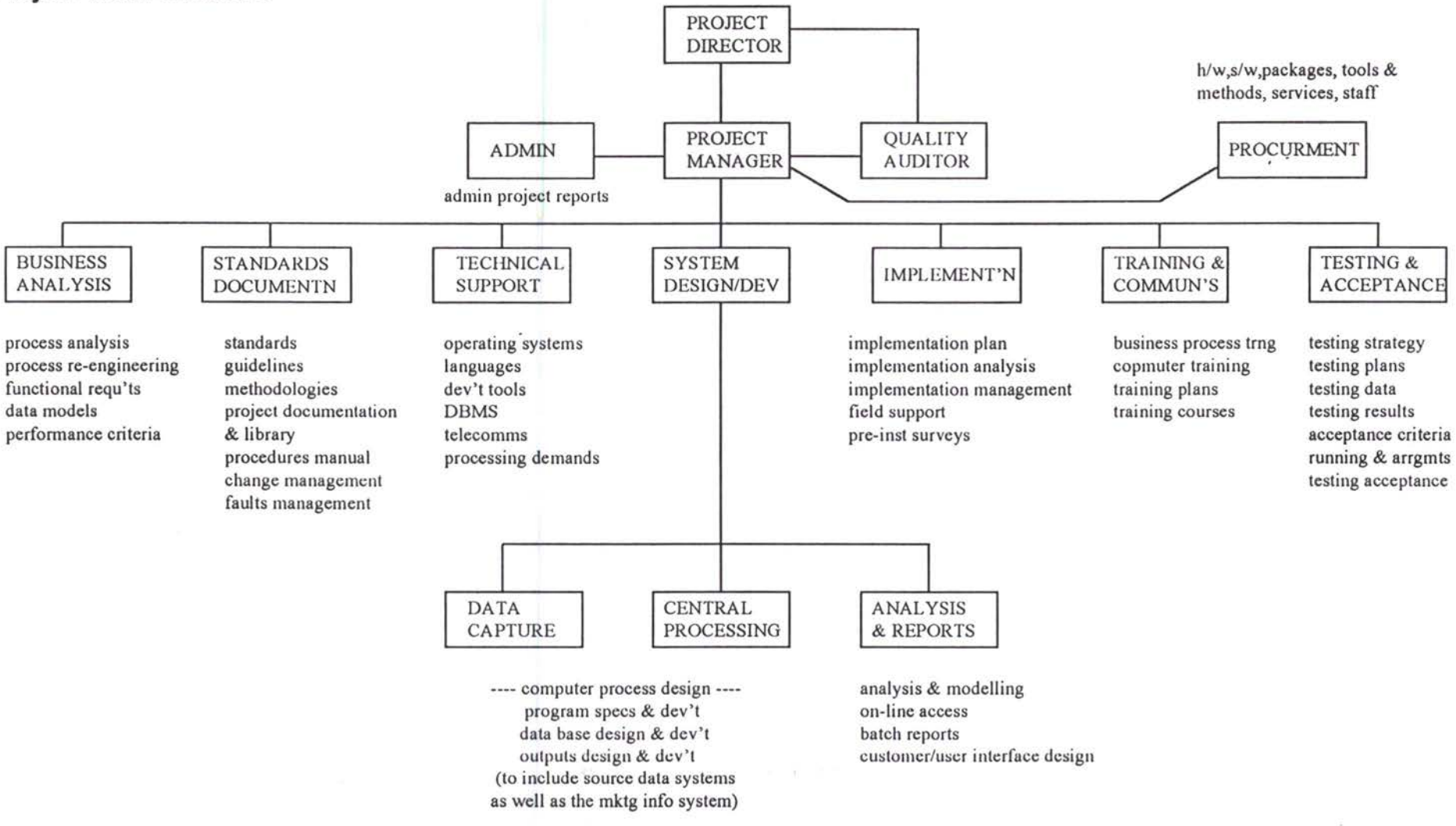
The primary work stages to be included in the project plan are as follows :-

- Project/programme team set up
- Business process review and engineering
- Data requirements, modelling and processes
- Procurement of system "building blocks"
- System functional specifications
- Computer processes design and development
- Technical platform review, specification and implementation
- Development of decision support facilities
- Quality plan
- Testing strategy and plans
- Pilot implementation
- Pilot running
- System continuity
- Post implementation support
- Post pilot implementation
- Technical platform planning and support
- Training and communications

### 11.3.5.2. Project Team Structure

The following diagram represents a recommended project team structure. It should be the first task to tackle and after appointments have been made and the team is set up; it is important to communicate the fact to all concerned - not merely to those in specific functions at headquarters level :-

## Project Team Structure



## 11.3.6 Uncertainties and Risks

### 11.3.6.1. Minimising the Risks

The achievement of successful development and implementation will necessitate the identification of uncertainties and risks at an early stage of project planning, and the taking of actions and decisions during the procurement, planning and resourcing work stages, to minimise such risks.

The following table demonstrates the perceived areas of risks involved in the project and each should be addressed in detailed work planning, quality check points, etc. to minimise adverse effects:

### 11.3.6.2. Matrix of Risk Areas

**Key** H = High risk M = Medium Risk L = Low Risk

| | Knowledge/ Skills Available | Resource Availability | Management Support | Work Content | New Technology | Technology Availability |
|---|---|---|---|---|---|---|
| **Project Elements** | | | | | | |
| Project Management | H | H | H | M | - | - |
| Business Process Review | M | M | H | M | - | - |
| Business Needs Spec'n | H | M | H | M | - | - |
| Technical Platform | | | | | | |
| -Hardware | L | M | M | L | L | L |
| -Software | M | M | M | M | L | L |
| -Telecomms | M | M | M | H | H | H |
| Resourcing | H | - | H | M | - | - |
| Management | H | M | - | M | - | - |
| Outside Suppliers | L | M | M | M | - | - |

## 11.4.0. Costs and Timescales

### 11.4.1. Estimates and Assumptions

It is assumed that processing hardware needs to be purchased for TDY headquarters computer centre (Operational and development/standby).

LAN requirements are based on a standard profile for the total railway (153 stations being absorbed into 20 notional areas or input points). Each LAN will have four terminals. Two LANs are assumed at TDY headquarters.

Unit costs for processors are based upon competitive tender responses to British Rail Business Systems projects of a similar nature to the financial management system and information provided by Digital, Hewlett Packard and IBM (UK).

Package software costs re taken from similar British Rail sources and advice as the hardware above and also from SAP (UK). Bespoke software is estimated upon knowledge of data interfaces and general MIS systems.

Items 3, 4, 5, 6, 7, 8 and 9 in the cost table are based upon experience of similar implementations and allocation of manpower resources between internal and external (to TDY) - this is largely on the basis that the suggested pilot site will have high levels of external experienced manpower. During the pilot period, knowledge will be transferred to internal resources who will carry out full implementation supported by only a few external persons.

External consultants time costed at :-

Senior consultants @ £1000 per day for 200 days/year
Other consultants @ £750 per day for 200 days/year.

Training and communications costed as above. Work basis is for the external consultants to design the training courses and to "train the trainers" who will then train the TDY system users.

Expenses are calculated on the external consultants days in Turkmenistan @ $100 per day and travel expenses.

Contingency included in the cost table is as follows :-

Processors 20%; Software 10%; items 3-9 10%; training and communications 5%; expenses 5%.

It should be noted that the costs shown do not include internal TDY resources.

### 11.4.2. Manpower Resources

The following table shows the **external manpower resources necessary to accomplish the FMS system over a two year timescale. Further external manpower costs have been added to the cost table to cover the subsequent system development** and implementation included in the total suggested MIS plan over a five year period.

| *Project Task* | *Description* | *External Resources* |
|---|---|---|
| Training & Communication | External experts to train TDY trainers | 2<br>(6 months) |
| Project Management and administration | One external expert (for development and implementation) | 1<br>(two years) |
| Business process analysis and re-engineering | External staff for expertise for training of TDY staff; to do pilot business processes and guidance on full implementation | 4 -2<br>(1.5 years) |
| Standards and Documentation | Accounting Package experts | 1<br>(one year) |
| Technical Support | External experts to support new technologies plus knowledge transfer | 3<br>(one year) |
| Systems specification and design | External experts for package functional software | 3<br>(one year) |
| Computer process development | External experts on package software | 3<br>(one year) |
| Implementation | expert in the new package software for the pilot | 1 |

### 11.4.3. Cost Table

The following table represents the costs (first two years of table) involved in developing and implementing a Financial Management system and necessary interfaces with existing systems. The remaining three years of the table indicate the likely costs of developing and implementing the rest of the MIS plan recommended in this document.

For reasons mentioned earlier no telecommunication transmission costs have been included but at this stage it is perhaps useful to reiterate the conclusions of the TACIS Infrastructure Maintenance 2 Report (module B) and these follow the cost table.

**COST TABLE**

£000's

| No | Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|
| 1. | Computer Processors | 180 | 180 | - | - | - | 360 |
| 2. | Software : | | | | | | |
| | FMS Accounting Package | 60 | | - | - | - | - |
| | Bespoke Interfaces | 20 | 50- | 20 | - | 50 | 140 |
| | Payroll & Passenger | | | 20 | - | | 20 |
| | Fixed Assets | | | | 20 | | 20 |
| | Project Accounting | | | | 20 | | 20 |
| | Stores/ Inventory | | | | 50 | | 50 |
| 3. | Business Process Review and Re-engineering | 300 | 150 | - | 300 | 150 | 900 |
| 4. | Project Team/Management | 150 | 150 | 150 | 150 | 150 | 750 |
| 5. | Standards and Documentation | 150 | - | - | 150 | - | 300 |
| 6. | Technical Support | 300 | 150 | - | - | - | 450 |
| 7. | Systems Specification & Design | 400 | 200 | 200 | - | - | 800 |
| 8. | Program Development & Testing | - | 350 | - | 200 | - | 550 |
| 9. | Implementation and Support | - | 150 | - | 150 | - | 300 |
| 10. | Training and Communications | - | 150 | - | 150 | - | 300 |
| 11. | Expenses | 95 | 95 | 25 | 85 | 20 | 320 |
| 12. | Local Equipment : | | | | | | |
| | LANS (22) | 28 | 290 | | | | 318 |
| | Terminals (88) | 8 | 80 | | | | 88 |
| | | | | | | | |
| | **GRAND TOTALS** | **1691** | **1995** | **415** | **1275** | **370** | **5746** |
| | **US Dollars (at 1.7 = 1£ )** | **2875** | **3391** | **705** | **2167** | **629** | **9767** |
| | | | | | | | |

**Conclusions of the TACIS Infrastructure Maintenance 2 Report (Module B)**
**TRACECA Rail Maintenance Central Asia - Turkmenistan**

**Telecommunications Equipment**

To perform the daily maintenance tasks, **it is urgent to invest 500,000 USD for new instrumentation and various tools in the short term.**

Some sections of the TRACECA corridor need to be equipped with a new transmission backbone in the next few years, in order to maintain an acceptable level of train operations. All these removed installations should be used later, as spare parts for the secondary lines. The main sections of lines to be renovated are the following:

- Ashgabat to Nebit-Dag (400 km.)
- Dushak to Farap Uzbekistan border (440 km. )

**The total estimated cost for telecommunication rehabilitation is about 15,000,000 USD.**

# 12 Human Resources

## 12.1 Introduction

The first part of this report deals with the review of the current situation in TDY under the headings indicated, and the second part deals with proposals on the role of the human resources function in expediting and facilitating the restructuring of TDY and changing it into a commercially oriented enterprise: proposals to assist TDY in developing a comprehensive plan for dealing with the future changes in the business and in managing the staff reduction process so that it does not cause disruption to services or unnecessary hardship to the staff that are affected; and the conditions under which staff numbers can be reduced taking account of the current policy on retirement, pensions, voluntary severance etc.. The possibility of staff reductions through privatisation and buyouts is examined.

## 12.2 Staff Numbers

Statements showing the numbers employed in the railway at 1 January 1991 and at 1 August 1997 are set out in Appendix 13. The numbers shown for 1 January 1991 have been reduced by approximately 9 000 employees who were employed on ancillary services relating to schools and kindergartens, healthcare facilities, higher education and training institutes and railway shops all of which had been transferred from the railway to relevant central government ministries.

In addition to the above mentioned reduction there was, in the period between 1991 and 1997 a reduction of over 2200 or approximately 10% in the numbers employed. This reduction, which is commendable, was achieved by management following a policy of attrition in relation to the filling of vacancies. There is a very low level of staff turnover in TDY staff. The reductions were achieved in parts of the railway where surplus staff already existed rather than as a result of a planned cost reduction programme designed to try and reduce costs in line with traffic and losses in real revenue.

It was clear from discussions that the culture in TDY did not envisage or welcome the concept of planned redundancy and that any redundancy was seen as a last resort to be avoided if at all possible. Senior management in the Human Resources function did, however, recognise the need to modernise and restructure the railway and to make it more commercial and customer focused, notwithstanding acute social difficulties which could arise.

There are no records readily available at present in TDY of the length of service and ages of employees. When such information was requested it was indicated that its provision would be a major and time consuming task as the records were not computerised.

The statement of staff numbers in Appendix 13 is divided into two parts (1) Main Activities and (2) Other Activities. This differentiation in classification is no longer significant. It had significance up to recently when TDY had a large number of employees working on activities which were not directly related to provision of rail services such as healthcare, education and retailing but as stated above, these have all been hived off to relevant ministries. The staff groups which now remain in the "Other Activities/Ancillary Activities" category are all working on railway transport related activities. They number slightly more than 2000 persons, about 10% of the total number employed. TDY has taken some steps to rationalise this latter category of staff. For example they have set up the unit which provides services to private sidings of industrial enterprises as a separate state enterprise "Promzheldortrans" and they have also reorganised by way of merging or demerging a number of activities in the Track Services Division. It is appropriate that this type of rationalisation would continue as an integral part of the change process.

There are more than 230 Line Stations and Subdivisions on TDY's network. Taking into account the passenger and freight volumes carried, it is clear that at many of the smaller locations on the rail

network, the volumes of passengers and freight handled and the resulting net revenues are too small to justify keeping these stations and depots open in the long term. The actual number of staff likely to become redundant will be determined by the number and locations which TDY decides to rationalise or close.

## 12.3 Severance Terms

### 12.3.1 Redundancy Before Pensionable Age

The law of Turkmenistan provides for the possibility of terminating the service of employees due to redundancy and it sets out the procedures to be followed in such cases. These procedures envisage redundancy as something which should be considered only as a very last resort. They require that every effort be made by the employer to secure alternative employment for the redundant worker and that appropriate retraining be provided. The employer must work closely with the state's employment and training agencies. The dismissal procedures are summarised in Appendix 14.

There are statutory regulations governing the payment of severance pay. These regulations provide for a once off payment on being made redundant and monthly payments for a maximum of three months from the date of redundancy. They could not be considered attractive. Appendix 14 contains a summary of the terms of severance pay and privileges. Pensions are paid from the National Exchequer and severance pay from TDY's funds.

Employees enjoy fringe benefits such as living accommodation, education and healthcare services. In the event of redundancy, arrangements need to be made to ensure the continuity of these benefits.

### 12.3.2 Retirement On Reaching Pensionable Age

According to legislation men do not become eligible for pension before 60 years of age nor do women before 55, except in the case of women with 5 or more children in which case the age can be 50. The employer pays a percentage of the total wages bill by way of contribution to the state towards the cost of pensions and other social benefits. The conditions governing the payment of pensions are common to all employees in Turkmenistan, not only those in the railway, and modification of them would be a major operation requiring legislation.

The Ministry for Social Security pays the basic pension of each railway employee in accordance with the national rules. The treatment of fringe benefits is covered by the statutes. The railway can, however give extra privileges and make supplementary payments to employees with long service.
It was not possible to establish in the time available, if there is any legal prohibition on TDY paying money from its own resources by way of pensions for staff who might be forced to leave its employment in the interval between the time of early retirement and reaching the age at which they would become eligible to receive the pension from the State

It is clear that it will be very difficult to make it attractive for TDY employees to consider taking either redundancy or early retirement on pension unless the amounts payable by way of gratuity or annuity under the present arrangements can be enhanced. It would be consistent with current practice in market economies to allow enhancement of such payments from railway funds which would be generated from savings arising from new and more efficient working of the railway. A corollary to making such an arrangement would be that it would be necessary to make provision in the accounts of TDY to cover the financial liability of additional pension payments.

### 12.3.3 Fringe Benefits

A high proportion of TDY employees is given either dormitory accommodation or housing. The personal circumstances of each employee are taken into account in deciding on allocations. An

employee on reaching 10 years service with TDY is given full legal title to the occupancy of the accommodation and responsibility for maintenance of the dwelling passes from the TDY to the local authority. The management of the process of allocating housing in TDY is the responsibility of the Civil Structures Section. Health, education shopping services are also provided for railway employees through the Ministries of Health and Education and Trade respectively.

## 12.4 Recruitment Training And Staff Development

### 12.4.1 Embargo on Recruitment

An embargo on recruitment has operated in TDY in recent years but particularly for the last two years and a directive from the Ministry of Economics required that TDY along with other employers reduce their staff by 10% between 1995 and 1997. TDY state that they have achieved this reduction. Limited exceptions to the embargo have been permitted, particularly in the case of the "Young Specialist" grades. These categories of staff include people recruited from the Institute of Transport and Communications into technician and technologist grades.

The reductions appear, however, to have been achieved mainly by a process of attrition involving a policy of not replacing staff who retired on pension. Figures provided for 1995, 1996 and 1997 (up to the end of September) show that there was no significant difference between the numbers leaving the employment and the numbers recruited in these years which are as follows:

| | Recruited | Resigned/Dismissed |
|---|---|---|
| 1995 | 92 | 109 |
| 1996 | 111 | 93 |
| 1997* | 62 | 79 |

Of the 62 persons recruited in the first nine months of 1997, 46 were in the "Young Specialist" categories. It is reasonable to assume that if staff turnover figures continue at the low levels of recent years an embargo on recruitment will not be particularly effective as a means of getting staff numbers lowered. It would appear that more attractive incentives than the present ones will be required.

The recruitment of "Young Specialists" is governed by national educational policies. It is policy that employers such as TDY must support the education of this particular group. The policy appears to be that major employers like the railway must guarantee to absorb a predetermined number of young graduates each year from the third level educational institutions and thereby ensure that there will be a demand for the educational services which is backed up by career opportunities.

In addition to the commitment which TDY has to make to employ a certain minimum number of these graduates, the graduates are required to refund to the state the cost incurred in providing their education. They do this by way of a levy on their pay. This commitment cannot be fulfilled by the graduates unless they have paid employment

The Ministry for Education arranges the placements. The courses are of three to five years duration. This means that even if notice were to be given today by TDY that it wished to terminate this source of recruitment the supply would not dry up for four or five years. Between 40 and 50 Young Specialists are recruited in a year. In the first six months of 1997, 46 were recruited.

It is quite common to find three generations of the one family employed in the same work location. It has been stated that this tradition is very deeply rooted in TDY, particularly in the smaller and more remote locations on the railway and that any change of it will constitute major disruption for those concerned.

It is not the practice in the railway to recruit staff on fixed term contracts of employment even though such a practice is permitted by the law. Such a practice is not at present seen by TDY as appropriate to its needs and is therefore not adopted by them.

There is in TDY a formal procedure for managing succession planning for 42 of the 50 most senior management posts, up to but excluding the rank of department head and General Director, which posts are filled by the Cabinet of Ministers. The scheme was developed at central government level and there are well documented regulations and criteria governing the scheme.

### 12.4.2 Training And Development

Staff training and development in TDY was managed by the Railway Technical Institute. The higher level training services were delivered by the Institute itself and at vocational level they were provided by the railway vocational schools. The courses in the vocational schools covered the basic knowledge and skills needed to run a railway e.g. driving, signalling and electrical services, shunting, passenger and freight train working, infrastructure construction and maintenance and overhaul and maintenance of rolling stock and equipment.

The Railway Technical Institute was in 1997 taken away from TDY and given to the Ministry for Education. This was done by Presidential Decree at the request of TDY. As a result of this decision TDY is in the somewhat unique position now in that it is a major business, employing many people but does not have a training function within its own control. The post of Head of Training still exists nominally in TDY but it is not planned to fill it. All of the costs associated with the running of the Institute are met by the Department of Education, with the exception of costs associated with the provision by TDY of accommodation and equipment for the purposes of practical training.

The objectives and syllabi of the various training courses are all well documented. They are quite appropriate to the current needs of the railway but many of them would require considerable adaptation and change if they are to be meet the future needs of the new TDY.

The overall numbers of railway personnel who receive training each year (approximately 300 people) is small by standards of European railways. This may be explained by the fact that there has been relatively little change or innovation occurring in TDY and also by the fact that there a reduced demand for training because of the low level of recruitment.

Examination of the records of training activity indicates that currently, training for all levels of railway personnel concentrates almost exclusively on railway operations and/or related technical subjects and the related administrative procedures. There is nothing in the syllabuses dealing with the principles and practices of modern management in a market economy. Likewise, training designed to meet the needs of Information Technology is very basic and the trainers are not given the basic modern equipment necessary to meet current training needs.

The classroom facilities available are quite adequate to current and foreseeable needs, subject, perhaps to some modernisation but there is an urgent need to install new computer equipment for use in providing training in information technology.

The Turkmenistan National Economics Institute provides some courses in business related subjects. It was not possible to arrange to meet with the Institute in the time available to try to assess the relevance of its courses to the future needs of the railway.

Prior to Turkmenistan gaining its independence, TDY relied to a significant extent on the Railway Institute in Moscow and on a branch in Tashkent to provide much of the international dimension of its education and training needs. Since Independence TDY provides this international dimension to its training by arranging overseas visits (as distinct from participation in formal training experiences) to Asian and European railways. It has no formal links for training purposes with international or European railway organisations.

While there may be an awareness at senior management level in TDY that it must prepare itself to conduct its business in a market economy environment there are no plans in place in the railway or in the Institute to facilitate the adaptation of training objectives and syllabuses towards this end. A cursory assessment of the educational background and experience of the faculty members would

suggest that they will require special practical and theoretical training in these topics as soon as possible.

## 12.5 Productivity

As stated in the terms of reference staff productivity has dropped markedly since 1992. As mentioned previously, the total number of staff has reduced since 1992 The reduction has been totally insufficient to counteract the losses in revenues and traffics, after allowing for inflation. The drop in productivity between 1992 and 1997 poses a serious threat to the long term survival of TDY. The way to a secure future is to plan and develop new cost effective services in the passenger and freight businesses which the customers will be prepared to use and to pay for. It is essential that the downward trend in revenues without any corresponding decrease in expenditures be reversed. To achieve such a goal it will be essential to get significant improvements in staff productivity.

## 12.6 Communications

The procedures for consultation and collaboration between management and the trade unions are very well established in TDY. The union will have a vital role to play in the process of implementing the changes which will affect so many aspects of the working life of the employees. There have been no discussions with the unions as yet about restructuring. It will, however be essential that the process of consultation be commenced as soon as an overall picture of the changes proposed has been prepared and formally adopted as policy.

## 12.7 Towards the future

### 12.7.1 Involvement In The Change Process

The development of a revitalised TDY will require faster, reliable, trains which will be competitively priced. The comfort and cleanliness of the passenger trains will be of a high standard. Each employees will know his/her job and will be motivated to ensure that the customer gets the best possible service from TDY. The rolling stock for passengers will be clean, well heated and ventilated and maintained to a high standard. The freight rolling stock will be well maintained and properly equipped and fully suitable for the traffic concerned. Station waiting rooms and offices to which the travelling public will have access will be clean, comfortable and well maintained. The management and staff will be trained and competent to manage the new TDY and to ensure that the highest levels of service are delivered to the customers,

The changes proposed in the methods and equipment which will be used for administrative work coupled with the many changes that will be required in operating methods, rolling stock, track maintenance equipment and equipment used in the overhaul and maintenance workshops will result in reductions in the number of jobs required at all levels in the railway. The manning requirements for passenger trains will be reduced when modern heating systems and improved ticket issuing and revenue protection arrangements are introduced. The scrapping of obsolete rolling stock and the gradual introduction of new stock will require less maintenance and therefore less staff.

It must be borne in mind. however that downsizing is not an objective in itself but a direct consequence of restructuring and modernising the railway.

The consultants proposals demonstrate the need to make changes in the administration units in the Head Office of TDY and also the need to introduce new work methods and computerisation in all aspects of administrative work. These changes will also result in some reduction in the number of staff required.

The reductions in staff will be offset to a small extent by the need to recruit some additional staff with new knowledge and skills, necessary for the efficient management of computer services, marketing and economic and business planning services.

A more precise picture of the extent of these changes is given in the reports of the different experts .The recommendations prepared by the consultants for each part of TDY will give details of the changes that will be required. Plans will then have to be prepared by the management giving details of how the changes will be implemented. These plans will also show the staffing levels that will be required to work the new systems.

It would not be possible at this point in time to make a reliable assessment of what number of staff will be needed for the future. The cost of staff, which at present represents approximately 26% of total revenues, will escalate at the same rate or perhaps even at a higher rate than the rate of inflation in the national economy. It is of critical importance, therefore that the number of staff employed by TDY kept to the absolute minimum so that costs can be tightly controlled.

The pace at which the changes are made will be the main determinant of the rate at which staff will become redundant. It would seem reasonable to work on the basis that reductions of the order of 25% or approximately 5500 people will need to be achieved over the first five years of the implementation process. This figure can be validated as part of a step by step process as the implementation proceeds.

Implementation of the proposed changes will have far reaching effects on the staff of TDY. It will be imperative that staff and the trade unions at all levels be fully informed about the proposed changes as soon as the overall plan and each successive stage of implementation is authorised and it has been decided that they are to be implemented. It will be equally important that the process of implementation is seen by all concerned to be open and fair. The establishment of special consultative machinery to facilitate the implementation process should be given very serious consideration. This machinery could involve the establishment of a Central Consultative Council which would be under the Chairmanship of the General Director and would have as members the Head of the Trade Union, two managers of Department Head rank and two elected representatives elected by the staff. In addition to the Central Consultative Council there would be a Departmental Council in each of the major Departments.

Each Departmental Council would have the department manager or the senior deputy manager as its Chairman and would have trade union representation, elected representatives of the staff of the department and departmental management. Each council would meet at least twice in each year and its principal function would be to deal with the programmes for change and to communicate as necessary with all concerned in the process of implementing the changes. The working of each council would be facilitated by representatives of the project teams and working groups which will be set up to ensure successful implementation of the various projects. The work of the consultative councils would be confined to dealing with matters relating to the restructuring process and the working of these councils would have to be closely co-ordinated with that of other consultative bodies which already exist in TDY.

### 12.7.2 Downsizing

In 1991 TDY carried a volume of traffic which was four times greater than it carries to-day. The staff reduced by 3098 people (approx. 13% ) in the interval.

If it is assumed that the ratio of traffic volumes to staff numbers employed represented an acceptable level of productivity in 1991, a reduction in staff of the order of 70% or over 15,000 would be required to keep the ratio in line with to day's traffic volumes. The railways finances will not be able to sustain the present high ratio of staff numbers to traffics carried for much longer. It should also be noted that the work practices and operating methods which have been in use since 1991 are labour intensive and that it would be reasonable to expect closer ratios to apply when TDY has been modernised and re-structured.

In these circumstances it is likely that staff reductions of the order of 75% or higher could be justified in ideal conditions.

It is of critical importance that TDY commence a programme of downsizing which is based on achievable realistic targets. The target of a 75% reduction in manpower is realistic and in line with European railway norms, but it is ambitious. It is recommended therefore that a target of a 60% reduction ( approx. 13,000 employees ) be adopted and that a downsizing programme be initiated without delay designed to achieve this target over a 10 year period.

The table set out hereunder shows projections for each of the main activities and for the ancillary activities . The programme envisages that by the end of 1999 staff reductions of the order of 12.5% would be achieved, and that 80% of the targeted reductions would be achieved by the end of 2002.

TABLE OF TARGETED STAFF REDUCTIONS IN YEARS 1997 TO 2007

| Main activities | Staff at 1-8-97 | Reductions targeted for years 1999 | 2002 | 20005 | 2007 | Total reduced |
|---|---|---|---|---|---|---|
| Loco. depots | 3081 | 385 | 1155 | 154 | 154 | |
| Wagon depots | 1771 | 220 | 660 | 91 | 90 | |
| Pass. Ashgabat | 1716 | 215 | 625 | 85 | 84 | |
| Signal & comm. sections | 1681 | 210 | 630 | 84 | 84 | |
| Track Services | 4693 | 590 | 1760 | 230 | 234 | |
| Elect. supply sections | 465 | 59 | 171 | 22 | 22 | |
| Moving serv. Ashgabat | 2672 | 335 | 1005 | 132 | 132 | |
| Moving serv. Chardjev | 1761 | 220 | 660 | 88 | 90 | |
| Civil constr. section | 766 | 100 | 300 | 30 | 30 | |
| Central admin. office | 337 | 43 | 127 | 16 | 17 | |
| Other enterprises | 273 | 35 | 105 | 24 | 22 | |
| Ancillary activities | 2343 | 300 | 900 | 103 | 115 | |
| Total reduction | | 2712 | 8098 | 1059 | 1074 | 12,943 |
| Total remaining | 21573 | 18861 | 10763 | 9704 | 8630 | |

## 12.8 The Social Safety Net

Because of the far reaching impacts the changes will have on staff it will be imperative that arrangements are made to ensure that the adverse consequences of the changes for individuals and for groups of staff are minimised. It is quite feasible to assemble a package of arrangements which would become a "Social Safety Net" designed to protect those who will be affected from the more serious consequences of the changes. The principal elements in the "Social Safety Net" would include:

- supplementary pension payments over and above the basic state pension which would make it possible for employees who might be willing to do so, to retire on pension at an earlier age than the present ages;

- financial arrangements which would make it attractive for younger employees who would not qualify for a pension to leave the employment of the railway and perhaps take up a new career;

- financial compensation which would be payable to employees who might have to change to a new work location, particularly when a change of residence might be involved;

- likewise financial compensation which would be payable in cases where employees would lose income as a result of demotion or transfer to another location.

## 12.9 Incentives To Increase Productivity

The existing staff of TDY will experience a lot of change by way of learning new skills, adapting to working with new equipment and new work methods and in some cases working in new locations. In addition, new staff will need to be recruited who will have the new skills necessary for the efficient management of a market oriented organisation. These changes will give rise to the need to develop new wage structures to reflect the skills and responsibilities involved in the restructured jobs.

The concept of productivity payments can be introduced into the process of developing new wage structures. This concept involves compensating employees who assume new and increased duties and responsibilities as a result of the introduction of new skills or the merging in whole or in part of skills and responsibilities which had formerly belonged to grades which had become obsolete. The concept envisages that staff who demonstrate flexibility and collaborate in the process of reorganisation and restructuring of jobs in a way which enables significant savings in staff costs to be made will also be able to share in the resulting savings. The concept of productivity payments can be very beneficial to workers in a nation which experiences high rates of inflation because the process of productivity dealing generates savings which can be made available to pay wage increases without creating inflationary pressures by adding to the cost structure of the enterprise. It is recommended that serious consideration be given to the feasibility of introducing this concept into the restructuring process as a part of the Social Safety Net.

## 12.10 Staff Development And Training

The objective of the restructuring project is to support the Government of Turkmenistan and TDY in their efforts to achieve the restructuring of the railway in the light of its current and expected future market opportunities and the railway's goal to be a commercially driven and financially self sustaining enterprise

The success of the restructuring will require the compilation of a comprehensive new inventory of the skills that will be required to support the new ways of working. It will require the establishment of new skills groupings and significant re-arrangement of job grading structures and working relationships.

The Institute of Transport and Communications provides, at present, much of the professional training for TDY's management and supervisory staffs. This training is designed to ensure that new recruits and persons being promoted to higher responsibilities are competent to discharge their duties in the context of the railway's current needs. The approach of the Institute to this work is systematic, detailed and competent as is the process of assessing academic progress and the technical competence of its trainees and graduates. The syllabuses and job descriptions are comprehensive but do not provide the knowledge and skills which will be necessary to equip managers and other staff to successfully manage the railway in its new market place. They have not been reviewed since the foundation of TDY in 1991.

The Institute does not, at present, provide courses in modern management subjects. This type of training will be essential to enable management and supervisory staff to operate the railway efficiently in the future. The Institute does have a Chair of Information Technology with a small staff of experts. It has only a minimum of equipment and this is very low powered and old. It is inadequate and will not serve any useful purpose in meeting the information technology training needs of the new TDY.. It is recommended that the question of ensuring the provision of the necessary training in information technology for staff in the Training Institute be given a very high priority and that it should be dealt with as part of the Information Technology element of this Project.

It is also recommended that the research role and the international liaison role of the Railway Faculty of the Institute be upgraded as a matter of urgency.

It was mentioned above that the position as head of the training function is vacant at present. There is a critical need to have this senior management position filled in order to ensure that full advantage

can be taken of the critical role that must be played by the training function in ensuring successful implementation of the changes which will be needed. It is quite inappropriate that a major enterprise like TDY should not have its own senior executive in charge of the training and development function, particularly as it is about to face a period of major change..

The lack of availability of education and training in modern management principles and practices will be a serious inhibitor of progress towards enabling TDY to exploit fully the opportunities for increased business which will arise as the nation develops. There is a need to have a faculty of management established in Turkmenistan which would serve the needs of all commercial enterprises, including TDY as they prepare to compete in the emerging market economy. The need and urgency is such as would warrant the provision of significant funding from international sources to supplement the government's resources. Consideration should be given, as a matter of urgency to the establishment of a management teaching and research unit in the National University or in one of the other institutes of higher studies.

## 12.11 Recruitment

There is one aspect of current recruitment practice in TDY which needs re-examination and that is how to source people with expertise in a variety of subjects relating to management in a market economy. The railway will, shortly, need such people at graduate, middle management and in a limited number of instances at senior management level. People with such qualifications are in scarce supply in Turkmenistan at present.

It is recommended therefore that TDY reconsider its approach to recruiting certain specialist staff by way of fixed term contracts. This method of recruitment involves offering a contract of employment to for a fix period, typically, one two or three years during which that person would provide services to TDY relating to his particular speciality. The rate of pay for the duration of the job would of necessity be significantly higher than would apply to managers employed under the present regulations. A condition can be included in the contract that the person must provide certain training in his/her particular expertise or discipline to some existing TDY staff. Employers in some developing economies where there are shortages in the supply of people with expertise in modern management have found this approach to recruitment to have been effective. Among other things this approach can provide an opportunity to entice home people who emigrated from Turkmenistan to a market economy where they had received university education in modern management subjects.

## 12.12 Summary

The primary objective of the restructuring is to develop TDY into an organisation that will operate a railway which will meet the transport needs of Turkmenistan as it grows and develops into a self sufficient market economy. One of the principal consequences of the restructuring will be the emergence of the need for TDY's management and staff to develop new skills and new standards of performance consistent with survival and growth in a market economy.

To achieve its objectives TDY will have to rationalise its services (passenger and freight), significantly improve the standards of its services, introduce new working methods, retrain its management and staff and shed surplus staff. It is proposed that the staff numbers need to be reduced by approximately 25% or 5500 people over a five year period.

TDY has since 1995 succeeded in reducing its staff numbers by 10% - more than 2200 people.

TDY must make a commitment to communicate openly and frankly with all its employees about all aspects of the restructuring and as a corollary must establish appropriate consultative machinery.

The achievement of the necessary staff reductions will result in social disturbance for many of the railway's staff. TDY must make a commitment to its staff to protect them against the more adverse

social consequences of the restructuring process by developing a Social Safety Net. This safety net will contain provisions which will be designed to (1) minimise the financial consequences for employees of becoming redundant (2) enable redundant employees to take their pension at an earlier age than at present (3) provide for financial compensation for those who suffer a loss of earnings due to demotion or transfer (4) provide for a sharing by the employees of part of the net savings achieved - by way of productivity payments.

The current embargo on recruitment will continue.

Special arrangements must be made to provide training for railway managers and supervisors in modern management principles and practices. The research facilities of the training Institute need to be upgraded.

Special attention must be given to providing training in information technology and the facilities and faculty must be upgraded.

The post as Head of Training must be filled.

There is a need to have a higher level institute for teaching of modern management in Turkmenistan. Training and development will play a key role in the restructuring process.

There is a critical need for TDY to recruit managers who are competent in modern management principles, including marketing, finance and business planning.

# 13. Environmental Review

## 13.1 Introduction

The present Environmental Review is aimed at the identification of the main environmental issues linked with the restructuring process and at the proposition of the corresponding mitigation measures. Knowing that little attention has been given yet to environmental problems in Turkmenistan, this report is also intended to have an educational purpose.

According to the EBRD's Environmental Policy and Procedures, the present project of railways restructuring in Turkmenistan 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 380 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.

## 13.2 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 TDY regulations and procedures.

### 13.2.1 State Legislation

#### 13.2.1.1 Main Environmental Laws

In Turkmenistan, issues related to the environment and natural resources management are regulated by several legislative acts and decrees, among which are:

- On measures for improving the environmental situation in the Caspian Sea Basin (June, 1991)
- On protection of nature (November, 1991)
- On State specially protected areas (May, 1992)
- Sanitary Code (May, 1992)
- On underground richness (December, 1992)

- Forestry Code (April, 1993)
- On protection and rational utilisation of fauna (December, 1993)
- On State ecological expertise (June, 1995)

The Law on Nature Protection (1991) 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 humans being and the environment, to preserve ecological systems, natural landscapes, and to guarantee citizens rights for healthy environment.

#### 13.2.1.2 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 with the currently effective legislation and regulations and to be approved by the agencies of the Ministry of Nature Use and Environmental Protection (MNUEP). It is understood that, reconstruction, retooling, or expansion of an active enterprise also requires an EIA if the original construction was carried out without EIA.

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. Permissible limits for emissions, discharges, and solid wastes are defined. Passports must be updated every five years, or whenever an alteration is made that would affect the quantities of wastes or pollutants produced as planned. These documents are prepared by the agencies of the MNUEP. The amounts of emissions and wastes calculated through the environmental passport serve as a basis for the annual charge each polluting enterprise is supposed to pay. These charges are supposed to supply a specific environmental protection fund.

All enterprises must prepare a «plan of environmental activity » to be signed by both the enterprise manager and the local authority of the MNUEP. Theses plans can be considered as brief, much less detailed, environmental passports. Basically, their purpose is to present the objectives of the enterprises in the field of waste and pollution reduction. They must be updated annually. If the objectives are not met, thorough explanations must be provided to the environmental authorities.
All enterprises must transmit the data contained in the environmental passports and in the plan of environmental activity to the State Statistical Committee, in order to make possible the statistical use of these data at a regional or national level.

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 country territory.

Surface and underground waters in Turkmenistan 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.

Exceeding any one of the maximum permissible concentrations or emissions result in financial penalties (fines). It must be pointed out that all the norms currently applied in Turkmenistan are still Former Soviet Union (FSU) norms. It is understood that new national norms are currently being prepared.

### 13.1.2 Internal TDY Regulations

TDY 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.

For instance, the FSU standard SNIP 32-01-85 gives some basic guidelines for the protection of the environment when designing or constructing railway projects.

Nevertheless, the Department of Labour Safety and Environmental Protection (DLSEP) is responsible for issuing specific « acts » for ensuring the respect of the environmental regulations within the company. These acts are kinds of statements by which the DLSEP, after site visits, notify that some TDY enterprise or other does not comply with the current regulation in the field of health or environmental protection. The manager of the concerned enterprise is then demanded to remedy the problem as soon as possible. These site inspections, sometimes followed by the issuing of « acts », can thus be considered as internal procedures of surveillance and control. However, all the statements must be stocked over a ten years period, and made available for potential review by the environmental authorities.

### 13.1.3. Structures, Organization and Responsibilities

Responsibility for environmental issues is distributed according to the hierarchy, through the Order n°273/N from 25.10.1996 on distribution of responsibilities within TDY:

- the First Deputy of the General Director is at the top of the hierarchy;
- the Chief Engineer of the Railways Management is in charge of co-ordinating all related matters;
- the head of the DLSEP is personally responsible for this issue within the railways organisation;
- 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.
- lower in the subordination hierarchy, all work aimed at the protection of the environment is the responsibility of one engineer (sometimes two in the biggest TDY units) from the operations security department of the enterprise.

The bodies entrusted with the control of compliance with the environmental regulations are the Cabinet of Ministers, the Major State Inspection (as far as industrial safety is involved), the MNUEP and its local agencies.

The Department of Labour Safety and Environmental Protection is supposed to assist the TDY operational departments for ensuring the respect of the environmental regulations within the company. The DLSEP is in charge of the preparation of the annual « plan of environmental activity » and is entrusted with a control function through the issuing of « acts ».

The DLSEP current staff is only one person, who is entrusted with both safety and environmental issues. Two years ago, the Department amounted to three persons: the department chief, one safety expert, and one environmental expert. Owing to the recent drop in the Railways activities, two posts were suppressed and the department chief stood alone. Obviously, the remaining person is not sufficient to deal with all safety and environmental issues within the TDY (there are 47 identified enterprises in the company requiring environmental specifications). Hence, the DLSEP work currently focuses almost only on safety problems. In addition, the DLSEP work includes a lot of administrative tasks (preparation of the plans of environmental activity for each TDY enterprise, issuing acts, managing the relations with the environmental authorities, etc.) which are all the more tedious since the Department does not have any computer tool. Lastly, the DLSEP is devoid of any monitoring mean (e.g. gas analyser or water pollution analyser) allowing them to implement effective analysis in the field.

Poor technical and human resources of the Department does not permit the carrying out of necessary planned activity to monitor emissions and wastes at the enterprises. This factor impedes the resolution of environmental disputes with the agencies of the MNUEP at the railway enterprises.

## 13.2 Baseline Environmental Data

General Information on the Geographical, Economic, main health and Environmental issues are included in Appendix 15

### 13.2.1 Environmental Issues Related To The Rail Transport Sector

The rail transport sector does not constitute a real source of environmental impacts. On an environmental standpoint, it is mainly considered as a source of noise, air and water pollution. However, it is important to emphasise that, compared to the other transport modes, the rail transport is by far the most environmentally friendly.

## 13.3 Key Environmental Issues of the Restructuring Process

### 13.3.1. Nature of the Project Components likely to Induce Environmental Effects

At the time of the writing of the present report, the project definition is still in progress. For example, the precise location of the critical sections to be rehabilitated is still unknown, as well as electrification needs. Moreover, electrification issues are out of the scope of the present study; they will be dealt with later on in the framework of another study.

Thus, the restructuring process will be mainly based - for project components likely to induce environmental effects - on the following aspects:

- track rehabilitation (intensive maintenance),
- improvement of the ballast quality,
- replacement of part of the existing machinery for track maintenance,
- procurement of some new machinery for track maintenance,
- replacement or re-engining of part of the locomotive fleet,
- upgrading locomotive and coach maintenance facilities and workshops.

Track rehabilitation will include the replacement of 500,000 timber sleepers by new concrete sleepers. The critical sections are supposed to cover 386 km of railway line. The old sleepers will be stored for potential use on secondary track sections. However, it is supposed that about 50 % of them will be too much worn for an actual reuse and hence will be sold for other purposes. The timber sleepers will be replaced within a five years period by precast concrete sleepers to be manufactured in the Ashgabat sleeper factory. It is assumed that, this factory being recent, only slight improvements will be needed for providing this additional railway equipment.

Track rehabilitation will also include ballast refill on approximately 20 % of the railway network. About 500,000 $m^3$ of ballast will be required. The ballast will be extracted in the two railway quarries presently operating. The ballast quality will be improved by the up-grading of the screening and crushing installations of the quarries.

The procurement of new machinery for track maintenance will include tamping machines, lining machines, ballast cleaners, equipment for sleeper inserting gangs, ballast regulating machines, trucks, and diverse small tools.

As to the rolling stock, it is expected to replace 8 locomotives, and to re-engine 20 locomotives. The Ashgabat locomotive and coach workshops will be upgraded. It is assumed that the planned investments will allow a slight increase in the express trains commercial speed.

### 13.3.2 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 the appendices will not be repeated.

#### 13.3.2.1 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 or workshop.

#### 13.3.2.2. 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 damage neither the microclimatic conditions, nor the drainage pattern of surface waters and groundwater. It is assumed that the drainage of the railway terrace at Geok-Tepe will be improved.

***Impacts on the Natural Environment***

The railway infrastructures to be rehabilitated may include some railway sections crossing the Repetek Desert Reserve. No change in the severance effect is expected. However, the works phase is likely to induce additional disturbances and pollution risks in this protected area.

The train speed being slightly increased on the whole renewed lines, the collision risks with wild animals 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 as well as in the horizontal alignment of the railway lines.

#### 13.3.2.3 Impacts on Spatial Organisation

The project will permit the reduction to some extent of the journey 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.

### 13.3.3 Pollution Generated by the Operation of the Rehabilitated Lines

#### 13.3.3.1 Traffic Forecasts on the Rehabilitated Lines

According to the most optimistic 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 40 % growth is expected by the year 2007. However, even in such circumstances, the traffic level on the busiest sections will stay very low (24 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.

#### 13.3.3.2 Energy Consumption and Air Pollution

With the replacement of the oldest locomotives by new ones and the re-engining of others, significant decreases in energy consumption and air pollution are expected.

#### 13.3.3.3 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 growth in the most optimistic scenario will lead to a slight increase of the noise emissions (by less than 1 dB(A) in any case),

- 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 alongside the rehabilitated track sections.

#### 13.3.3.4 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.

With respect to accidental pollution, one can say that the probability for accidents will decrease, because of the combination of several factors, such as track rehabilitation, improvement of the maintenance operations, replacement of part of the rolling stock.

For a slight improvement of the operation speed, the rehabilitated lines will thus benefit from significant improvements and so will gain in safety.

On the network, 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 recall that the main aquifers are deep. Hence, they are on the whole well protected against either accidental or chronic pollution.

#### 13.3.3.5 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.

### 13.3.4 Impacts during the Works Period

#### 13.3.4.1 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 technical specifications.
Within the planned rehabilitation works, the main operations will be sleepers and ballast replacement.

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/day), it does not require work tracks since the access is provided by the railway track.

#### 13.3.4.2 Waste Production

Track rehabilitation operations are first characterised by the production of a considerable quantity of waste :

- 500,000 $m^3$ of ballast,
- 500,000 timber 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.

The old timber sleepers are usually stocked and used afterwards on secondary tracks. However, generally half of them are too much worn to be reutilised and then are sold or given as firewood. Knowing that they are treated with creosote, their burning can generate toxic smokes.

#### 13.3.4.3 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 the existing quarries, with associated disruption of land use, loss of habitat, visual intrusion, ... The screening and crushing installations of the quarries are

generally the source of significant noise and dust emissions. On that standpoint, the upgrading of these installations is assumed to bring some improvement;

- 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 Ashgabat sleeper factory, which will lead to some process improvement, likely to be helpful to the environment.

- transport and storage : noise, dust, vehicle traffic, ... It must be emphasised that all the required materials can be extracted or manufactured in the country. 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 Turkmenistan, 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.

## 13.4 Transport of Dangerous Goods and Safety Issues

### 13.4.1. Transport of Dangerous Goods

#### 13.4.1.1. 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.

#### 13.4.1.2 The Turkmen Context

In Turkmenistan, railway transport is used to convey nearly all dangerous products which are mainly hydrocarbons (from 30 to 50 % of the total freight transport, according to the source), ammonia, chlorine, acids, used for industrial purposes and chemicals used in agriculture (pesticides, fertilisers).

It is assumed that less than 1 % of the freight transport (excluding hydrocarbons) corresponds to transport of dangerous goods. Most of the dangerous goods are transported in tank wagons which have a high age profile.

In 1985, a collision between two trains resulted in chlorine emissions, but without any serious consequences. Three or four small incidents involving transport of dangerous goods are reported to occur each year (mostly leaks of gas). The main reasons evoked for these incidents are usually the poor condition of tracks, but also the deterioration of wagons.

### 13.4.1.3. 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)[1] 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,
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.

Turkmenistan has not as yet joined the RID convention. The regulation in force is 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 Turkmen regulations and international conventions, but the codification used is completely different. The list of dangerous goods defined by UNO is currently used by the Turkmen authorities. There is a list of goods whose import into Turkmenistan is prohibited.
Some negotiations are on the way for achieving an harmonisation between the current regulation and the RID convention.
Within TDY the control and surveillance of transport of dangerous goods is provided by the Service of Special Goods Transportation in the Transportation Department. This service deals also with exceptional convoys. They are in charge of control of rolling stock condition and train composition (when dangerous goods are transported). Their field of intervention covers the main lines as well as the sicings. The Service of Special Goods Transportation has close co-operation procedures with the State Committee for Emergency Situations.
Transport of dangerous goods is subject to specific licensing procedures from governmental authorities and approval by the TDY Transportation Department.

### 13.4.1.4 Impact of the Railways Rehabilitation on the Transport of Dangerous Goods

At present, the Turkmenistan's railway network 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

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[1] Règlement International concernant le transport des marchandises Dangereuses par chemin de fer

accidents should however decrease, because of the combination of several factors, such as track rehabilitation, improvement of the maintenance operations, replacement of part of the rolling stock.

For a slight improvement of the operation speed, the rehabilitated lines will thus benefit from significant improvements and so will gain in safety.

### 13.4.2. Other Safety Issues

During the Consultant's visits to several railway stations and journey on the Ashgabat-Mary line, the main identified safety problem was the uncontrolled crossing of numerous pedestrians (sometimes with heavy burden) and livestock, mostly around stations. Along the lines (outside urban areas), this problem does not seem to be acute owing to the low population density.

A visit in the Ashgabat Locomotive Maintenance Depot has been used to assess how safety issues are tackled in TDY industrial units. It was observed 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, ...) are often missing or are stored in locked cupboards. to prevent their theft.

## 13.5 Proposed Mitigation Measures

### 13.5.1. 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 TDY who are required to commit themselves 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.

### 13.5.2. 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,
- Ashgabat 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 DLSEP personnel on behalf of the design team, in close co-ordination with regional agencies of the State Committee for Nature Protection.

## 13.5.3. Measures related to the Rehabilitated Lines Operation

### 13.5.3.1. Introduction

Basically 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.

Such accompanying measures are not compulsory regarding Turkmen regulations, but it 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 ensures 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 Turkmen railways - will be dealt with in this section:
- reduction of noise and vibration,
- reduction of water and soil pollution.

### 13.5.3.2. Reduction of Noise and Vibrations

Field visits performed by the Consultant suggest that in many dwelling areas alongside the railway lines, the permissible noise levels are presently exceeded and will be in the future, regarding the Turkmen 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.

Nevertheless, it must be emphasised that the construction or installation of noise protection devices will be justified only if, in other respects, strong measures are taken by the municipal authorities to avoid new settlements in the close vicinity of the railway lines.

According to the situation found in the field, the following anti-noise protection devices should be implemented:

| Type of measure | Type of location | Purpose | Construction material | Indicative unit cost in ECU (under EU standards) | Efficiency |
|---|---|---|---|---|---|
| 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 base plate pads | 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; here the least expensive one is given. 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. Let us note that noise barriers also play a safety function by preventing unauthorised crossing of the tracks.
- 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 TDY 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 railway network. 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 base plate pads 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.

### 13.5.3.3. Reduction of Water and Soil Pollution

#### 13.5.3.3.1. 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.
- 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).

#### 13.5.3.3.2. Specific Measures For The Protection Of Water Resources

In Turkmenistan, as in other arid countries, the protection and sustainable management of the water resources is a matter of survival, and should be given the first priority.

The groundwater resources are not much used yet, but constitute major stakes for supplementing surface water resources in the future, especially to guarantee drinkable water supply in the cities of the country. The Presidential Resolution n°1690 of March 10, 1994 « On measures for expanding the use of groundwater supply to the urban areas of Turkmenistan » envisages the acceleration of works on drafting, construction and implementation of facilities for water supply from groundwater.
Accidental pollution, especially when involving transport of dangerous goods, is a major threat regarding the protection of aquifers.

The railway network 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 undertaken 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 / $m^2$ 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 TDY's staff without external assistance.

#### 13.5.3.3.3. 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.

Regarding the scarcity of surface waters in Turkmenistan, each stream should 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.

### 13.5.4. 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.

#### 13.5.4.1. 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.

#### 13.5.4.2. Measures Related To Track Rehabilitation

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, TDY 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 could be performed by the DLSEP under the control of the environmental authorities. 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.

- TDY 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).
- TDY 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 wastes generated by this work phase (ballast, sleepers,...), specific measures will be implemented for their disposal or re-use :

- 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 wastes 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. TDY will have to submit a Recycling Plan which shall specify the types and quantities of wastes 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.

Before the sale of any timber sleepers as fire wood, warnings should be given to the purchasers regarding possible intoxication by the smoke. The use of timber sleepers in open fireplaces should be especially banned.

### 13.5.5. Measures Related To Rolling Stock Replacement

Using new diesel locomotives or re-engined 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 air conditioning systems, 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.

### 13.5.6. 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 Turkmenistan, 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, thorough safety expertise should be carried on for each industrial unit of TDY by an independent organism. Such expertise could last approximately one day per site and is assumed to amount to about 18,000 ECU if international consulting is required.

### 13.5.7. Reinforcement Of The DLSEP Means

At the present time, the absence of means of either the Department of Labour Safety and Environmental Protection or the Railway Design Institute in the field of environmental expertise would make it necessary to use external experts to carry out the complementary studies and the monitoring activities linked with the implementation of the mitigation measures of the restructuring project.

Instead of turning to external - and expensive - assistance, it is recommended to reinforce the current one person team by, at least. one environmental specialist.

This person would be entrusted with two different tasks:

- on the one hand, he would be responsible for the achievement and the follow up of all environmental activities within the restructuring process (preliminary environmental inspection, implementation of measures against noise and water pollution - with the possible help of skilled specialists, and ensuring the effective consideration of the mitigation measures during the works phase);
- on the other hand, he would deal with all environmental issues within the usual TDY activities (annual plans of environmental activity, site inspections and ensuing statements). As such, the environmental specialist would release the present DLSEP chief, who could then devote himself exclusively to safety issues.

In order to ensure the maximum effectiveness of the future DLSEP team, it is also necessary to supply them with the adequate tools for carrying out these new activities as well as their current duties. On that standpoint, needs are especially acute in equipment. More precisely these needs concern:

- one multi-media computer and software such as latest versions "Vega", "Atmosfera", "Hydrosfera", "Ecolog", developed by Russian specialists (≈ 3,000 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.

It is assumed that the new environmental specialist of the DLSEP will be familiar with computer use, air, water and soil pollution analysis and that no additional training will be required.

## 13.6. Environmental Management Action Plan

At the time of the writing of the present Environmental Review, no precise completion date was defined for the several components of the restructuring project. Thus, an 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 in the restructuring project | Preliminary environmental inspection (PEI) | 1,000 | completion of design works |
| Track rehabilitation | Reduction of noise emission and water pollution | ≈ 2 % of project total | works phase |
| Track rehabilitation | Measures related to the works period | no significant extra cost | works phase |
| Replacement of rolling stock and track maintenance machinery | Material with higher environmental performances | no significant extra cost | renewal of the rolling stock fleet and track maintenance machinery |
| Changes in operation, maintenance, and manufacturing practices | Safety measures | 18,000 | could be completed at once |
| TDY restructuring | Reinforcement of the DLSCEP means | 23,000 (excluding the environmental specialist hiring) | 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 DLSEP. Hence, given the current rates of salary, these studies cannot be considered as significant expenses. Furthermore, the environmental assessments which will be performed follow legal requirements regarding the Turkmen 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 Turkmen railway network, 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 Turkmenistan 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 or maintenance machinery replacement is included in the restructuring project. It is assumed that the new materials will be fitted with most of the required environmental improvements without additional cost.

**Abbreviations**

| | |
|---|---|
| EAP | Environmental Action Plan |
| ECU | European Currency Unit |
| EIA | Environmental Impact Assessment |
| EU | European Union |
| DLSEP | Department of Labour Safety and Environmental Protection |
| FSU | Former Soviet Union |
| MNUEP | Ministry of Nature Use and Environmental Protection |
| PEI | Preliminary Environmental Inspection |
| RID | International Regulation concerning Transport of Dangerous Goods by Railways |

# 14. Investment Analysis

The aim of the overall investment programme is to :

- improve the infrastructure maintenance and reduce the related costs
- improve operation and reduce the corresponding cost
- improve the locomotive utilisation and reduce maintenance cost
- provide TDY with the equipment, parts and materials to guarantee an efficient and safe operation.

Therefore the investments proposed are geared to two major areas : infrastructure and rolling stock.

Immediately TDY 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 TDY with a standard quality of materials in order to upgrade the lines (ballast, crossings, sleepers and bearers) and with the modern equipment to carry out the upgrading and maintenance activities.

On rolling stock TDY is experiencing a strong shortage of rolling stock and significant maintenance cost, cannibalising old existing stock. Considerable cost is incurred in having major overhauls of rolling stock outside Turkmenistan, utilising also scarce hard currency. The aim of the investment plan is to provide TDY with the facilities and equipment to be self sufficient in carrying out all repairs and overhauls in house.

The investments were split into 8 packages which were carefully evaluated on the basis of the information provided and the assumptions which had to be made. When information was lacking, simplification was achieved, making sure that these would not affect positively the results.

The investment program detail is shown underneath. It specifies the package number, the nature of investment, its cost, the expected IRR and the time schedule for implementation.

| | *TYPE OF INVESTMENT* | *COST* | *IRR* | *FIVE YEAR PROGRAMME* | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *in %* | *1* | *2* | *3* | *4* | *5* |
| | *I. INFRASTRUCTURE* | *38.36* | | *12.15* | *12.48* | *8.13* | *2.80* | *2.80* |
| PACK. 1 | Crossings | 0.40 | [1] | 0.20 | 0.20 | | | |
| | Assistance and training on resurfacing by welding | 0.10 | | 0.05 | 0.05 | | | |
| PACK. 2 | Concrete sleepers (to replace timber sleepers) | 14.00 | 15.83 | 2.80 | 2.80 | 2.80 | 2.80 | 2.80 |
| PACK. 3 | Improvement of concrete sleepers factory | 1.00 | 15.34 | 1.00 | | | | |
| PACK. 4 | Improvement of ballast quarries | 1.00 | 19.55 | 1.00 | | | | |
| | Tools | 2.00 | | 2.00 | | | | |
| | Tamping machine | 7.00 | | | 3.50 | 3.50 | | |
| | Equipment for 2 sleepers inserters gang | 2.80 | | 1.40 | 1.40 | | | |
| | Ballast cleaner | 3.00 | | 1.00 | 2.00 | | | |
| | Ballast regulators | 1.70 | | | 0.83 | 0.83 | | |
| | Ballast wagons | 1.40 | | 0.70 | 0.70 | | | |
| PACK. 5 | Purchase of equipment for SET | 4.00 | 14.00 | 2.00 | 1.00 | 1.00 | | |
| | | | | | | | | |
| | II. ROLLING STOCK | 51.00 | | 8.30 | 16.20 | 11.70 | 8.80 | 6.00 |

[1] Pay out time is 1 year

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PACK. 6 | Purchase 8 new freight locomotives | 24.00 | 11.47 | - | 6.00 | 6.00 | 6.00 | 6.00 |
| PACK. 7 | Re-engine 10 locomotives 2TE10 | 14.00 | 24.92 | 2.80 | 4.20 | 4.20 | 2.80 | |
| PACK. 8 | Upgrade loco workshops | 4.00 | 29.28 | 2.00 | 2.00 | - | - | - |
| | Upgrade coach workshops | 2.00 | | 1.00 | 1.00 | - | - | - |
| | Upgrade wagon workshops | 4.00 | | 1.00 | 1.50 | 1.50 | - | - |
| | Spares stock | 3.00 | | 1.50 | 1.50 | - | - | - |
| | | | | | | | | |
| | Technical Assistance to TDY in implementing restructuring | 4.64 | | 0.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| | | | | | | | | |
| | TOTAL | 94.00 | | 21.09 | 29.68 | 20.83 | 12.60 | 9.80 |

Most of these packages show acceptable IRR. The purchase of locomotives shows an IRR of 11.47%. Re-engining was limited to rolling stock which is not too old and in satisfactory conditions.

## 14.1 Turkmenistan Railways Five Year Investment Programme

A draft investment plan and programme has been prepared setting out the priority investment in areas of infrastructure, and rolling stock, involving replacement of track components, mechanisation of track maintenance, purchase of new locomotives, re-engining existing locomotives and upgrading locomotive and coach maintenance facilities and workshops. The amount of investment is constrained by the ability of TDY to accommodate interest and capital repayment on loans from international banks in its financial accounts. The Consultants are of the view that TDY's capability to incur interest and capital repayments limits the investment plan to about 100m$.

The recommended investments give high priority to :

(a) preserving existing assets in infrastructure and rolling stock rather than expanding capacity and
(b) specific investments targeted at introducing improved efficiency of the railways core business activities and are of course subject to economic and financial justification and evaluation.

The unit costs and full description of the items of investment are described in the relevant sections of this report, but the principal unit costs involved are as follows:

| **Infrastructure** | **Rolling Stock** |
|---|---|
| Concrete sleepers -28 $ each<br>Track Tamping / Lining machines-1.75 m$ each.<br>Equipment for sleeper inserting gangs-1.4m$ each<br>Ballast cleaning machine-3 m$ each<br>Ballast regulating machine-0.83m$ each | Re-engine existing locomotives-0.70 m$ each<br>New freight locomotive-3.0 m $ each<br>Provision of Hopper Ballast Wagons - 0.046 m$ each |

| TYPE OF INVESTMENT | TOTAL AMOUNT | FIVE YEAR PROGRAMME 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| INFRASTRUCTURE | | | | | | |
| | | | | | | |
| Upgrade and repair of P and C | 0.5 | 0.25 | 0.25 | | | |
| Manufacture 500,000 concrete sleepers | 14.0 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |
| Improve concrete sleeper factory | 1.0 | 1.0 | | | | |
| Improve two ballast quarries | 1.0 | 1.0 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Provide 30 hopper ballast wagons | 1.4 | 0.7 | 0.7 | | | |
| Purchase of powered mtce. Tools | 2.0 | 2.0 | | | | |
| Mechanise track maintenance : | | | | | | |
| 4 Tamping/Lining machines | 7.00 | | 3.5 | 3.5 | | |
| Equip 2 sleeper inserting gangs | 2.8 | 1.4 | 1.4 | | | |
| Purchase ballast cleaning machine | 3.0 | 1.0 | 2.0 | | | |
| Purchase 2 ballast regulators | 1.66 | - | 0.83 | 0.83 | - | - |
| | | | | | | |
| Purchase of equipment for SET | 4.0 | 2.0 | 1.0 | 1.0 | - | - |
| Total infrastructure investment | 38.36 | 12.15 | 12.48 | 8.13 | 2.80 | 2.8 |
| | | | | | | |
| **ROLLING STOCK** | | | | | | |
| Purchase 8 new freight locomotives | 24.0 | - | 6.0 | 6.0 | 6.0 | 6.0 |
| Re-engine 10 locomotives 2TE10 | 14.0 | 2.8 | 4.2 | 4.2 | 2.8 | - |
| Upgrade loco workshops | 4.0 | 2.0 | 2.0 | - | - | - |
| Upgrade coach workshops | 2.0 | 1.0 | 1.0 | - | - | - |
| Upgrade wagon workshops | 4.0 | 1.0 | 1.5 | 1.5 | - | - |
| Spares stock | 3.0 | 1.5 | 1.5 | - | - | - |
| Total rolling stock | 51.0 | 8.3 | 16.2 | 11.7 | 8.8 | 6.0 |
| | | | | | | |
| Provide for technical assistance to TDY in implementing restructuring | 4.64 | 0.64 | 1.0 | 1.0 | 1.0 | 1.0 |
| | | | | | | |
| Total investment programme | 94.00 | 21.09 | 29.68 | 20.83 | 12.60 | 9.80 |

The items included in the Investment Plan, with the exception of the equipment for mechanised track maintenance have been agreed with TDY. In relation to track maintenance equipment, TDY consider that their present equipment, which is attached to the Track Renewal Enterprises, is adequate for their present and future track maintenance needs, and they wish to replace a number of items of existing equipment as set out under the heading Additional Items required by TDY in the following listing :

Additional Items required by TDY

| | |
|---|---|
| Purchase of 4 cantilever gantry cranes | 2.0 m$ |
| Purchase of 1 ballaster | 0.8 m$ |
| Purchase of 3 motorised platform units | 0.6 m$ |
| | --- |
| Total TDY requirement | 3.4 m$ |

**INVESTMENT IN INFORMATION TECHNOLOGY EQUIPMENT**

The required investment in information technology, computerisation, and management information systems, amounting to 9.767m$ over a five year period, is set out in the following table, and the Consultants understand that this can be catered for under the provisions of the Japanese loan already negotiated by TDY, which has an allocation for equipping the newly constructed computer building in Ashgabat.

**COST TABLE**

**£000's**

| No | Item | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Total |
|---|---|---|---|---|---|---|---|
| 1. | Computer Processors | 180 | 180 | - | - | - | 360 |
| 2. | Software :<br>FMS Accounting Package | 60 | | - | - | - | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bespoke Interfaces | 20 | 50- | 20 | - | 50 | 140 |
| | Payroll & Passenger | | | 20 | - | | 20 |
| | Fixed Assets | | | | 20 | | 20 |
| | Project Accounting | | | | 20 | | 20 |
| | Stores/ Inventory | | | | 50 | | 50 |
| 3. | Business Process Review and Re-engineering | 300 | 150 | - | 300 | 150 | 900 |
| 4. | Project Team/Management | 150 | 150 | 150 | 150 | 150 | 750 |
| 5. | Standards and Documentation | 150 | - | - | 150 | - | 300 |
| 6. | Technical Support | 300 | 150 | - | - | - | 450 |
| 7. | Systems Specification & Design | 400 | 200 | 200 | - | - | 800 |
| 8. | Program Development & Testing | - | 350 | - | 200 | - | 550 |
| 9. | Implementation and Support | - | 150 | - | 150 | - | 300 |
| 10. | Training and Communications | - | 150 | - | 150 | - | 300 |
| 11. | Expenses | 95 | 95 | 25 | 85 | 20 | 320 |
| 12. | Local Equipment : | | | | | | |
| | LANS (22) | 28 | 290 | | | | 318 |
| | Terminals (88) | 8 | 80 | | | | 88 |
| | | | | | | | |
| | GRAND TOTALS | 1691 | 1995 | 415 | 1275 | 370 | 5746 |
| | US Dollars (at 1.7 = 1£ ) | 2875 | 3391 | 705 | 2167 | 629 | 9767 |
| | | | | | | | |

## 14.2 Economic Justification Of Investments

### 14.2.1 Introduction

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

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

Therefore the infrastructure has deteriorated leading to reduction of the average speed on the network during recent years, the number of speed restrictions having increased significantly (about 6.5 % of the total network).

The size, condition and performance of the traction fleet has reduced considerably and TDY has reached today its maximum transportation capacity.

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 these needs, two sets of solutions were produced :

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

The projected cost of the infrastructure improvement programme is set at 38.36m$. It includes purchasing of materials for infrastructure upgrading, improvement of materials production sites and mechanisation of maintenance.

The estimated cost of the rolling stock investment programme is estimated at 51m$. It includes, in addition to maintenance facilities improvement, the purchase of 8 diesel units and the re-engining of 10 locomotives.

The main impact expected is to allow TDY to meet freight and passenger transport demand with the most adapted investments and to reduce its costs.

## 14.2.2 Method For Project Evaluation

### 14.2.2.1 Definitions

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

*Financial Internal Rate of Return :* it corresponds to the maximum rate at which the company (TDY) 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 interest rate for which the revenue net present value (capital value) of the project equals 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 off time* corresponds to the time by which the investment will be paid back.

### 14.2.2.2 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

### 14.2.2.3 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 performance is neither improving nor deteriorating. 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 is not 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.

#### 14.2.2.4 The Project Case

The project case (also called S1 in the tables produced for financial evaluation) will be based on the expected evolution of TDY 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 TDY, 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-off time is longer than a year. The economic assessment of the proposed investments including benefits due to time savings or accident reduction are not included : due to the lack of information in terms of sensitivity to travel times, any traffic increase due to travelling time reduction resulting from any investment, has not been taken into consideration. On one side it is considered that time savings are often relatively marginal and on the other side, the value of time of passengers and goods is significantly low in central Asia, and particularly in Turkmenistan. Unfortunately no figure on accidents (such as derailments) was provided by TDY. It has not been possible to take into consideration the potential for such accidents on the base case.

Therefore the Internal Rates of Return produced are lower than these which occur because the anticipated benefits taken into account are under the reality, since all criteria were not taken into account.

All figures are expressed in dollars at a rate of 1USD=5200 Manats.

### 14.2.3 Hypothesis

#### 14.2.3.1 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 sensitivity to traffic levels is fairly high on such investments which allow reduction of speed restrictions and improve the average speed. Therefore the upgrading programme should give priority to the most loaded sections.

Anyway, due to the lack of rolling stock, any delay or time savings will affect :

1. the rolling stock rotation and requirements or
2. the total traffic transported in a way that total demand may or may not be met when considering that rolling stock requirement is and will exceed the fleet available.

The second assumption was taken.

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

OPTIMISTIC SCENARIO

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Traffic (ton-pass./km) | | | | | | | | | | | | | | | | | | | | | |
| Freight | 7432 | 7580 | 7732 | 8002 | 8283 | 8572 | 8873 | 9183 | 9504 | 9836 | 10180 | 10536 | 10904 | 11285 | 11680 | 12088 | 12511 | 12948 | 13401 | 13869 | 14354 |
| Passengers | 831 | 903 | 982 | 1123 | 1268 | 1419 | 1575 | 1736 | 1903 | 1941 | 1980 | 2019 | 2060 | 2101 | 2143 | 2186 | 2230 | 2274 | 2320 | 2366 | 2413 |
| Revenues | | | | | | | | | | | | | | | | | | | | | |
| Freight | 47,84 | 48,79 | 49,77 | 51,51 | 53,31 | 55,17 | 57,11 | 59,11 | 61,17 | 63,31 | 65,52 | 67,81 | 70,19 | 72,64 | 75,18 | 77,81 | 80,53 | 83,34 | 86,25 | 89,27 | 92,39 |
| Passengers | 4,52 | 4,91 | 5,34 | 6,11 | 6,90 | 7,72 | 8,57 | 9,45 | 10,36 | 10,56 | 10,78 | 10,99 | 11,21 | 11,43 | 11,66 | 11,90 | 12,13 | 12,38 | 12,62 | 12,88 | 13,13 |
| Profit | | | | | | | | | | | | | | | | | | | | | |
| Freight | 24,28 | 24,77 | 25,26 | 26,14 | 27,06 | 28,01 | 28,99 | 30,00 | 31,05 | 32,14 | 33,26 | 34,42 | 35,63 | 36,87 | 38,16 | 39,50 | 40,88 | 42,31 | 43,78 | 45,31 | 46,90 |
| Passengers | 0,04 | 0,04 | 0,04 | 0,05 | 0,06 | 0,06 | 0,07 | 0,08 | 0,08 | 0,09 | 0,09 | 0,09 | 0,09 | 0,09 | 0,09 | 0,10 | 0,10 | 0,10 | 0,10 | 0,10 | 0,11 |

PESSIMISTIC SCENARIO

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Traffic (ton-pass./km) | | | | | | | | | | | | | | | | | | | | | |
| Freight | 7432 | 7580 | 7732 | 7887 | 8044 | 8205 | 8369 | 8537 | 8707 | 8880 | 9057 | 9238 | 9422 | 9609 | 9800 | 9996 | 10195 | 10398 | 10605 | 10816 | 11031 |
| Passengers | 831 | 761 | 837 | 914 | 993 | 1074 | 1156 | 1240 | 1325 | 1352 | 1379 | 1406 | 1434 | 1463 | 1492 | 1522 | 1552 | 1583 | 1615 | 1647 | 1680 |
| Revenues | | | | | | | | | | | | | | | | | | | | | |
| Freight | 47,84 | 48,79 | 49,77 | 50,76 | 51,78 | 52,81 | 53,87 | 54,95 | 56,04 | 57,16 | 58,30 | 59,46 | 60,64 | 61,85 | 63,08 | 64,34 | 65,62 | 66,93 | 68,26 | 69,62 | 71,00 |
| Passengers | 4,52 | 4,14 | 4,56 | 4,97 | 5,40 | 5,85 | 6,29 | 6,75 | 7,21 | 7,36 | 7,50 | 7,65 | 7,81 | 7,96 | 8,12 | 8,28 | 8,45 | 8,62 | 8,79 | 8,97 | 9,15 |
| Profit | | | | | | | | | | | | | | | | | | | | | |
| Freight | 24,28 | 24,77 | 25,26 | 25,77 | 26,28 | 26,81 | 27,34 | 27,89 | 28,45 | 29,01 | 29,59 | 30,18 | 30,78 | 31,40 | 32,02 | 32,66 | 33,31 | 33,97 | 34,65 | 35,34 | 36,04 |
| Passengers | 0,04 | 0,03 | 0,04 | 0,04 | 0,04 | 0,05 | 0,05 | 0,05 | 0,06 | 0,06 | 0,06 | 0,06 | 0,06 | 0,06 | 0,07 | 0,07 | 0,07 | 0,07 | 0,07 | 0,07 | 0,07 |

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

- Cost price of the tonne-km: 16.48 Manats
- Cost price of the passenger-km: 28.07 Manats
- Revenue by tonne-km 33.47 Manats
- Revenue by passenger-km 28.30 Manats
- Profit by tonne-km 16.99 Manats
- Profit by passenger-km 00.23 Manats.

### 14.2.3.2 Costs

In order to produce balance sheets, several hypotheses on costs were to be taken. They are summarised in this paragraph.

#### 14.2.3.2.1 Staff

The present figures on staff costs are :

| | |
|---|---|
| Average monthly salary (per year) | 45 USD |
| Yearly average employee cost (incl.social charges) | 700 USD |

On base cases it has been assumed that employee cost increase is 3% per year. On project cases, it is assumed that it is around 10% up to 2002 and 5% after. Based on this assumption the cost of an employee per year in 2007 would be :

- Base case 913 USD
- Project case 1308 USD

In the project case wages would therefore be nearly 50% higher than in the base case.

The incentive to be given to employees for voluntary leaving is assumed to be a 1 year salary. It is estimated that it will affect 50% of the staff.

#### 14.2.3.2.2 Infrastructure

The cost of major items for renewal of infrastructure is shown underneath :

| | |
|---|---|
| Timber sleeper (imported) | 18 USD |
| Concrete sleeper (imported) | 31 USD |
| Concrete sleeper (local) | 28 USD |
| Timber bearers (imported) | 65 USD |
| Imported Concrete bearers | 100 USD |
| Concrete bearers | 80 USD |
| Crossing | 2000 USD |

### 14.2.3.3 Locomotive Inventory

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

#### 14.2.3.3.1 Locomotives

The age profile of the locomotives is as follows:

| *YEAR* | *2TE 10L* | *2TE10V* | *2TE 10M* | *2TE 10U* | *NOS.* |
|---|---|---|---|---|---|
| *1970* | *30* | | | | *30* |
| *1971* | *56* | | | | *56* |
| *1972* | *13.5* | | | | *13.5* |
| *1973* | *38.5* | | | | *38.5* |
| *1974* | *12* | | | | *12* |
| *1975* | *5* | | | | *5* |
| *1976* | *11* | *3* | | | *14* |
| *1977* | *4* | | | | *4* |
| *1980* | | *1* | | | *1* |
| *1982* | | | *5* | | *5* |
| *1983* | | | *1* | | *1* |
| *1986* | | | *8* | | *8* |
| *1993* | | | | *33* | *33* |
| ***Total*** | ***170*** | ***4*** | ***14*** | ***33*** | ***221*** |

On top of these locos, a 2M62U is also included in the park.

The condition of the existing rolling stock is the following :

| *TYPE* | *TOTAL* | *Condition* | | | | *Operating Daily Need* |
|---|---|---|---|---|---|---|
| | | *Parts* | *Factory repair* | *Depot repair* | *Serviceabl* | |
| ***2M62U*** | ***1*** | *-* | *-* | *-* | ***1*** | |
| ***2TE10L*** | ***170*** | ***38*** | ***28.5*** | ***52.5*** | ***51*** | |
| ***2TE10V*** | ***4*** | *-* | ***2*** | *-* | ***2*** | |
| ***2TE10M*** | ***14*** | *-* | ***3*** | ***1*** | ***10*** | |
| ***2TE10U*** | ***33*** | *-* | ***1.5*** | ***7.5*** | ***24*** | |
| ***TOTAL*** | ***222*** | ***38*** | ***35*** | ***61*** | ***88*** | ***95*** |

### 14.2.3.4 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 | 8 |
| Concrete sleeper | 40 |
| Diesel locos | 25 |
| Wagons | 35 |
| Coaches | 30 |
| Signals | 40 |
| Telecommunications | 50 |
| Machine tools | 40 |
| Hand tools | 10 |
| Handling equipment | 20 |
| Track maintenance equipment | 20 |
| Special tools | 10 |

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

- Timber sleepers : the quality of timber sleeper in TDY is poor.
- Concrete sleepers : with the present level of traffic, and in the climate of Turkmenistan (fairly dry) where the level of corrosion is lower than in western countries, a concrete sleeper lasts longer.

### 14.2.3.5 Speed Restrictions

Most of investments on infrastructure are justified partly by removal of speed restrictions. Today 150 km are under speed restrictions (around 6.5% of the total network) :

- About 25% of speed restrictions are caused by the poor conditions of switches. These speed restrictions lower the speed by 50% (down to 40 km/h).
- 40% are caused by a bad levelling. The speed restriction is, on average, 30 km/h.
- 10% are due to sleepers and the bad condition of the fastenings. The speed restriction is, on average, 40 km/h.
- 25% are due to other causes (on-going works mainly).

It has been considered that the existing situation will not deteriorate anymore, in terms of speed restrictions.

Considering the number of running time hours (in 1997 estimated at 116,498), the total number of hours lost due to speed restrictions is 9,591 as shown underneath :

| Causes | % of speed restrictions | Running hours without speed restriction | Speed restriction | Running hours with speed restrictions | Wasted time |
|---|---|---|---|---|---|
| Switches | 25% | 1893 | 40 | 3786 | 1893 |
| Levelling | 40% | 3028 | 30 | 8077 | 5048 |
| Sleepers | 10% | 757 | 40 | 1514 | 757 |
| Other | 25% | 1893 | 40 | 3786 | 1893 |

## 14.2.4 Infrastructure

### 14.2.4.1 Upgrade And Repair Of Points And Crossings

#### 14.2.4.1.1 Brief Description

The renewal of the infrastructure concerns two items :

- upgrade and repair of points and crossings
- assistance and training on resurfacing by welding.

The cost and schedule is shown underneath :

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Upgrade and repair of Points and Crossings + TA on welding | 0.5 | 0.25 | 0.25 | | | |

### 14.2.4.2 Base Case

The present infrastructure is facing a deterioration due mainly to the lack of materials. If crossings are not replaced, the number of speed restrictions due to switches is assumed to have an effect on operation costs (these are marginal when looking at the wages level) and rolling stock requirements.

Here, as mentioned in the paragraph dealing with traffic and revenues, instead of considering that TDY will purchase the rolling stock required to carry the estimated demand, the hypothesis was to identify the amount of traffic which will not be transported anymore due to the combined effects of speed restrictions and lack of rolling stock.

### 14.2.4.3 Project Case

#### 14.2.4.3.1 Impact Of The Project

If existing damaged crossings are replaced, it will permit the removal of all speed restrictions due to the poor condition of switches. Speed restrictions being removed, the overall travelling times will be reduced. This will impact on two items :

- operation cost : travelling times being reduced, driving hours will also be reduced.
- needs for extra rolling stock : the running hours being reduced, rolling stock required to carry the same amount of freight and passengers will be affected. Two possibilities were offered :
  - to consider that all traffic demand is to be met and therefore extra rolling should be purchased
  - to consider that all traffic demand will not be met and therefore revenues will be reduced accordingly to the amount of the time wasted

This second solution has been considered.

#### 14.2.4.3.2 Evaluation

The upgrade and repair of points and crossings allows a saving today, according to traffic levels of 1893 running time hours. A locomotive runs at present less than 1300 hours a year. Two extra locomotives would be necessary in the base case. Even if the performance of the purchased locomotive was higher than today's, at least one extra locomotive should be purchased. Taking as a basis a cost of 3m$ per locomotive, the initial amount of investment

(0.5m$) would be justified right on the first year.

If we consider that no rolling stock would be purchased, the reduction of revenue and profit before tax and depreciation would amount to 1.625% of the total. The profit which would be lost on the first year without upgrading would reach 0.4m$ [2]when the cost of the investment reaches 0.5m$. The pay-off time would be 1 year also.

### 14.2.4.4 Purchase Of 500,000 Concrete Sleepers

#### 14.2.4.4.1 Brief Description

The manufacturing of 500,000 concrete sleepers on a five years programme will permit the replacement of 60% of the remaining sections which are still equipped with timber sleepers (around 250 km). Around 170 km will be left with timber sleepers.

It will also allow for providing higher standard sleepers : their expected life is 40 years.

The cost and schedule is shown underneath :

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Manufacture 500,000 concrete sleepers | 14.0 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 |

The unit price assumed per sleeper is 28 USD.

#### 14.2.4.4.2 Base Case

Two base cases were to be considered :

1. In order to keep the operation in satisfactory conditions, timber sleepers which have outlived their life span will be replaced in due time by new timber sleepers.
2. The other solution was to leave things to continue to deteriorate, having more speed restrictions. Therefore every year the extra sections with speed restrictions of 40 km/h due to the bad condition of sleepers would be around 50 km. That means that each train would spend around 50 minutes more than if there were not any speed restriction. As an average there are 1000 freight trains on each direction on TDY network. When taking into account the number of running hours of a locomotive, the further need for locomotive is nearly 2 per year.

The cost of 2 locomotives being higher that 100,000 timber sleepers, it is considered here that TDY management would decide to replace timber sleepers in due time (base case n°1) rather than leaving things to deteriorate further.

#### 14.2.4.4.3 Project Case

##### 14.2.4.4.3.1 Impact Of The Project

The purchase of concrete sleepers which are produced locally instead of imported timber sleepers will postpone further replacements of sleepers (concrete sleeper life span being significantly higher than timber sleeper).

Cost of concrete sleepers set at 28 (USD) is more than 50% higher than timber ones (18 USD).

The other impact is to increase the life of sleepers up to 40 years.

[2] 1.625% of a profit assumed to be 24.32 MUSD

Two project cases were assessed after the five years when 500,000 timber sleepers were replaced by concrete sleepers :

1. replacement of the remaining timber sleepers in due time by concrete sleepers on an 8 years programme (project case n°1)
2. replacement of the remaining timber sleepers in due time by new timber sleepers (project case n°2).

#### *14.2.4.4.3.2 Evaluation*

For project case n°1, the IRR is 15.83 %

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Base case : S0** | | | | | | | | | | | | | | | | | | | | | | |
| Timber sleepers | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | |
| Cash flow | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | 6,65 | -31,35 |
| Residual value | | | | | | | | | | | | | 0,00 | 0,24 | 0,48 | 0,71 | 0,95 | 1,19 | 1,43 | 1,66 | 1,90 | 8,55 |
| **Project case : S1** | | | | | | | | | | | | | | | | | | | | | | |
| Concrete sleepers | 2,80 | 2,80 | 2,80 | 2,80 | 2,80 | 1,21 | 1,21 | 1,21 | 1,21 | 1,21 | 1,21 | 1,21 | 1,21 | | | | | | | | | |
| Cash flow | -2,80 | -2,80 | -2,80 | -2,80 | -2,80 | -1,21 | -1,21 | -1,21 | -1,21 | -1,21 | -1,21 | -1,21 | -1,21 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 14,57 | -9,07 |
| Residual value | 1,40 | 1,47 | 1,54 | 1,61 | 1,68 | 0,75 | 0,78 | 0,81 | 0,84 | 0,87 | 0,90 | 0,93 | 0,96 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 14,57 |
| S1-S0 | -0,90 | -0,90 | -0,90 | -0,90 | -0,90 | 0,69 | 0,69 | 0,69 | 0,69 | 0,69 | 0,69 | 0,69 | 0,69 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 7,92 | 22,28 |
| IRR | 15,83% | | | | | | | | | | | | | | | | | | | | | |

Pay-off time would be 11 years.

For project case n°2 , the IRR is 17.24 %.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : S0 | | | | | | | | | | | | | | | | | | | | | | |
| Timber sleepers | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | 1,90 | |
| Cash flow | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | -1,90 | 6,65 | -31,35 |
| Residual value | | | | | | | | | | | | | 0,00 | 0,24 | 0,48 | 0,71 | 0,95 | 1,19 | 1,43 | 1,66 | 1,90 | 8,55 |
| Project case : S1 | | | | | | | | | | | | | | | | | | | | | | |
| Concrete sleepers | 2,80 | 2,80 | 2,80 | 2,80 | 2,80 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | 0,78 | |
| Cash flow | -2,80 | -2,80 | -2,80 | -2,80 | -2,80 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | -0,78 | 11,96 | -13,66 |
| Residual value | 1,40 | 1,47 | 1,54 | 1,61 | 1,68 | | | | | | | | | 0,10 | 0,19 | 0,29 | 0,39 | 0,48 | 0,58 | 0,68 | 0,78 | 11,19 |
| S1-S0 | -0,90 | -0,90 | -0,90 | -0,90 | -0,90 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 1,13 | 5,31 | 17,89 |
| IRR | 17,24% | | | | | | | | | | | | | | | | | | | | | |

Pay-off time would be 9 years.

The project case n°2 looks better, but no assessment of the higher need of labour for replacing more often was produced due to the lack of justifiable estimates. Nevertheless, we can assume that the impact would be slightly significant.

The solution to be adopted should be between these two scenarios :
when some parts of the network with timber sleepers may not be facing a high level of traffic, replacement of timber sleepers could be postponed without a strong impact on operational performance.

### 14.2.4.5 Improvement Of Sleeper Factory

#### 14.2.4.5.1 Brief Description

The investment concerning the improvement of the sleeper factory will allow production of around 7,000 concrete bearers. The cost and schedule is shown underneath :

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Improvement of sleepers factory | 1.00 | 1.00 | | | | |
| **Total** | **1.00** | **1.00** | **0.00** | **0.00** | **0.00** | **0.00** |

### 14.2.4.5.2 Base Case

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

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

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

### 14.2.4.5.3 Project Case

### 14.2.4.5.3.1 Impact Of The Project

The main impact of the improvement of the sleeper factory will be to reinforce TDY autonomy. This will also allow for a reduced cost of the bearers (from 100 USD for an imported bearer down to 80 USD for a Turkmen bearer).

The production of 7,000 bearers would be enough to cope with TDY needs.

On top of this impact it is worth mentioning that some speed restrictions due to bad condition of switches is due to defective bearers. As this benefit was included totally in the benefits drawn from the replacement of crossings, it has not been taken into account in the benefits of producing locally concrete bearers.

### 14.2.4.5.3.2 Financial Evaluation

The IRR is estimated at 15,34 %.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BASE CASE : S0 | | | | | | | | | | | | | | | | | | | | | | |
| Imports of bearers | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | 0,70 | |
| Cash flow | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -0,70 | -14,78 |
| Residual value | 0,35 | 0,37 | 0,39 | 0,40 | 0,42 | 0,44 | 0,46 | 0,47 | 0,49 | 0,51 | 0,53 | 0,54 | 0,56 | 0,58 | 0,60 | 0,61 | 0,63 | 0,65 | 0,67 | 0,68 | 0,70 | 11,93 |
| PROJECT CASE : S1 | | | | | | | | | | | | | | | | | | | | | | |
| Own bearers production | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | 0,56 | |
| Investement in st. factory | 1,00 | | | | | | | | | | | | | | | | | | | | | |
| Cash flow | -1,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -0,56 | -12,78 |
| Residual value | 0,28 | 0,29 | 0,31 | 0,32 | 0,34 | 0,35 | 0,36 | 0,38 | 0,39 | 0,41 | 0,42 | 0,43 | 0,45 | 0,46 | 0,48 | 0,49 | 0,50 | 0,52 | 0,53 | 0,55 | 0,56 | 9,52 |
| S1-S0 | -0,86 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | 0,14 | |
| IRR | 15,34% | | | | | | | | | | | | | | | | | | | | | |

Pay-off time is approximately seven years.

### 14.2.4.6 Improvement Of Maintenance

### 14.2.4.6.1 Brief Description

This last package on infrastructure includes mechanisation of maintenance, purchase of tools and improvement of ballast quarries[3]. Details are given below :

**Investments related to mechanisation of maintenance**

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Mechanise track maintenance : | | | | | | |
| 4 Tamping/Lining machines | 7.00 | | 3.50 | 3.50 | | |

[3] This last investment might have been excluded from this package, as the nature of such item is different from the two other items. Nevertheless, its benefits are common to these produced by ballast wagons and purchase of equipment for improvement of grading.

| | | | | | | |
|---|---|---|---|---|---|---|
| Equip 2 sleeper inserting gangs | 2.80 | 1.40 | 1.40 | | | |
| Purchase ballast cleaning machine | 3.00 | 1.00 | 2.00 | | | |
| Purchase 2 ballast regulators | 1.66 | | 0.83 | 0.83 | | |
| Purchase 30 ballast wagons | 1.40 | 0.70 | 0.70 | | | |
| **Total** | **15.90** | **3.10** | **8.43** | **4.33** | **0.00** | **0.00** |

**Improvement of ballast quarries**

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Improvement of two ballast quarries | 1.00 | 1.00 | | | | |
| **Total** | **1.00** | **1.00** | **0.00** | **0.00** | **0.00** | **0.00** |

**Purchase of tools**

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Purchase of powered mtce. Tools | 2.00 | 2.00 | | | | |
| **Total** | **2.00** | **2.00** | | | | |

The investment which concerns purchase of tools will allow the replacement the existing obsolete or damaged tools and provide for extra required tools in order to carry daily maintenance.

### 14.2.4.6.2 Base Case

Things are considered to remain the same :

- the level of track maintenance staff is kept unchanged,
- time lost due to speed restrictions will amount to 9,581 hours adjusted according to traffic levels,
- operating performance and rolling stock fleet will be kept at the same level
- employees cost is following a yearly increase up to the year 2007.

Due to the shortage of rolling stock, these speed restrictions would impact significantly on the level of traffic which could be transported.

### 14.2.4.6.3 Project Case

#### 14.2.4.6.3.1 Impact Of The Project

The mechanisation of maintenance will first permit the upgrading of the overall standard of the line, removing most of the speed restrictions (due to defects in levelling, faulty sleepers or fastenings and on-going works) and allowing an overall 25% speed increase (from 80 km/h up to 100/km). Regulations limiting freight trains to 80 km/h should be removed, technical reasons for limiting heavy trains being eliminated. Staff operating cost should be reduced by 25%.

The other major impact of the project is to reduce the staff dedicated to track maintenance. The present staff number amounts to 3,000 people. It is believed that this figure could be cut by half within a five year program.

The provision for tools will assist the carrying out on a more efficient way any repair on the line and its materials.

Improvement of ballast quarries will permit the production of ballast at quantity and quality standards required. Nearly 50% of speed restrictions are due to defects in levelling. The provision of prime material and equipment (ballast wagon and other mechanised equipment) together with the improvement of ballast quarries will put back up to standards the faulty sections.

#### 14.2.4.6.3.2 Financial Evaluation

On the optimistic scenario, the Financial evaluation shows an IRR of 23.85 %, including all investments.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : BC | | | | | | | | | | | | | | | | | | | | | | |
| Profit | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | 24,32 | |
| Maintenance staff cos | 2,17 | 2,23 | 2,30 | 2,37 | 2,44 | 2,51 | 2,59 | 2,67 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | |
| Downtime cost | 0,65 | 0,67 | 0,69 | 0,71 | 0,73 | 0,75 | 0,77 | 0,80 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | |
| Total | 21,50 | 21,42 | 21,33 | 21,24 | 21,15 | 21,05 | 20,96 | 20,86 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 20,75 | 439,29 |
| Project case : S1 | | | | | | | | | | | | | | | | | | | | | | |
| Profit | 24,32 | 24,81 | 25,31 | 25,19 | 27,12 | 29,07 | 29,06 | 30,08 | 31,14 | 32,22 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | |
| Downtime cost | 0,65 | 0,76 | 0,71 | 0,67 | 2,70 | 0,74 | 0,77 | 0,81 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | |
| Maintenance staff cos | 2,32 | 2,23 | 2,10 | 1,93 | 1,62 | 1,70 | 1,78 | 1,87 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | |
| Leaving bonus | | 0,13 | 0,14 | 0,15 | 0,16 | 0,17 | | | | | | | | | | | | | | | | |
| Investment in mech m | 0,00 | 8,43 | 4,33 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| Total | 25,17 | 13,26 | 18,02 | 23,45 | 24,54 | 25,46 | 26,50 | 27,40 | 28,32 | 29,40 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 30,22 | 31,66 | 666,62 |
| Residual value | 0,32 | 0,71 | 0,43 | | | | | | | | | | | | | | | | | | | 1,44 |
| S1-BC | -8,29 | -8,16 | -3,31 | 2,20 | 3,49 | 4,41 | 5,55 | 6,54 | 7,56 | 8,65 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 9,47 | 10,91 | 126,23 |
| IRR | 23,85% | | | | | | | | | | | | | | | | | | | | | |

On the pessimistic scenario, it is 19.55 %.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : BC | | | | | | | | | | | | | | | | | | | | | | |
| Profit | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | 24,28 | |
| Maintenance cost : st | 2,17 | 2,23 | 2,30 | 2,37 | 2,44 | 2,51 | 2,59 | 2,67 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | 2,75 | |
| Downtime cost | 0,65 | 0,67 | 0,69 | 0,71 | 0,73 | 0,75 | 0,77 | 0,80 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | 0,82 | |
| Total | 21,47 | 21,38 | 21,30 | 21,21 | 21,11 | 21,02 | 20,92 | 20,82 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 20,72 | 438,62 |
| Project case : S1 | | | | | | | | | | | | | | | | | | | | | | |
| Profit | 24,28 | 24,77 | 25,26 | 25,77 | 26,28 | 26,81 | 27,34 | 27,89 | 28,45 | 29,01 | 29,59 | 30,18 | 30,78 | 31,40 | 32,02 | 32,66 | 33,04 | 33,04 | 33,04 | 33,04 | 33,04 | |
| Downtime cost | 0,59 | 0,76 | 0,71 | 0,67 | 2,70 | 0,74 | 0,77 | 0,81 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | 0,85 | |
| Maintenance cost : st | 2,32 | 2,23 | 2,10 | 1,93 | 1,62 | 1,70 | 1,78 | 1,87 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 | |
| Leaving bonus | | 0,13 | 0,14 | 0,15 | 0,16 | 0,17 | | | | | | | | | | | | | | | | |
| Investment in mech m | 0,00 | 8,43 | 4,33 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| Total | 25,17 | 13,22 | 17,98 | 23,22 | 23,80 | 24,20 | 24,79 | 25,21 | 25,63 | 26,20 | 26,77 | 27,36 | 27,96 | 28,58 | 29,20 | 29,84 | 30,22 | 30,22 | 30,22 | 30,22 | 31,66 | 641,47 |
| Residual value | 0,32 | 0,71 | 0,43 | | | | | | | | | | | | | | | | | | | 1,44 |
| S1-BC | -8,29 | -8,17 | -3,32 | 1,82 | 2,59 | 3,19 | 3,87 | 4,39 | 4,91 | 5,48 | 6,06 | 6,65 | 7,25 | 7,86 | 8,49 | 9,12 | 9,51 | 9,51 | 9,51 | 9,51 | 10,94 | 102,96 |
| IRR | 19,55% | | | | | | | | | | | | | | | | | | | | | |

Pay-off time is around 7 to 8 years according to the scenario.
These two simulations are taking into account differential staff wages increase with and without restructuring.

### 14.2.4.7 Signalling And Telecommunications

#### 14.2.4.7.1 Brief Description

This investment covers two items :

- *spare parts, tooling and instrumentation must be made available as fast as possible to ensure proper maintenance for all installations,*
- *the Turkmenbashi station installations stand in great need of modernisation.*

The cost is estimated at 4m$ and the investment would be achieved within a 3 years period.

| *Year* | *Total* | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|---|
| ***Purchase of equipment for SET*** | ***4.00*** | ***2.00*** | ***1.00*** | ***1.00*** | ***-*** | ***-*** |

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

#### 14.2.4.7.2 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 (6000 hours).
Staff level will be kept at 1790.

#### 14.2.4.7.3 Project Case

##### 14.2.4.7.3.1 Impact Of The Project

There have been, on average, about 2000 incidents on the network which have caused a total of nearly 6000 hours of delay. Through the investment and restructuring proposed the number of incidents would be decreased and their impact would be reduced by three times

(around 2000 hours). The reduction of such incidents would permit the carrying of extra traffic :
in 1996 about 7,000 million tonnes-km were transported in 141,420 hours giving 50,000 ton-km carried every hour.

If 4000 hours were saved through elimination of signalling incidents, some 200,000,000 extra tonnes-km would be transported each year without any need for further rolling stock.

#### 14.2.4.7.3.2 Financial Evaluation

The IRR is 14 %.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : SO | | | | | | | | | | | | |
| Maintenance cost | 0,95 | 0,97 | 1,00 | 1,03 | 1,06 | 1,10 | 1,13 | 1,16 | 1,20 | 1,23 | 1,27 | |
| Total | -0,95 | -0,97 | -1,00 | -1,03 | -1,06 | -1,10 | -1,13 | -1,16 | -1,20 | -1,23 | -1,27 | **-12,11** |
| | | | | | | | | | | | | |
| Project case : S1 | | | | | | | | | | | | |
| Profit surplus | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | 0,64 | |
| Maintenance cost | 0,91 | 0,90 | 0,99 | 1,09 | 1,14 | 1,20 | 1,26 | 1,32 | 1,39 | 1,46 | 1,53 | |
| Leaving bonus | 0,06 | 0,06 | | | | | | | | | | |
| Investment in SET | 2,00 | 1,00 | 1,00 | | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | |
| Total | -2,32 | -1,32 | -1,35 | -0,45 | -0,50 | -0,56 | -0,62 | -0,68 | -0,75 | -0,82 | -0,59 | **-9,94** |
| Residual value | | 0,10 | 0,20 | | | | | | | | | **0,30** |
| | | | | | | | | | | | | |
| S1-S0 | -1,38 | -0,35 | -0,34 | 0,59 | 0,56 | 0,54 | 0,51 | 0,48 | 0,45 | 0,42 | 0,68 | **2,17** |
| | | | | | | | | | | | | |
| IRR | **14%** | | | | | | | | | | | |

Pay-off time is less than 7 years.

Faulty signalling and telecommunications installations may incur several accidents which are not included in the evaluation.

## 14.2.5 Rolling Stock

### 14.2.5.1 Background

TDY traction fleet is old and has reached today its minimum size. The railways will not be, in the future, be able to carry the traffic expected without significant operational performance improvements and locomotives investments. To give a picture of the future of TDY in terms of locomotives available, a list of available locomotives, year by year, based on their theoretical life is produced underneath :

| REMAINING FLEET | | | | | |
|---|---|---|---|---|---|
| YEAR | 2TE 10L | 2TE10V | 2TE 10M | 2TE 10U | NOS. |
| 1995 | 140 | 4 | 14 | 33 | 191 |
| 1996 | 84 | 4 | 14 | 33 | 135 |
| 1997 | 71 | 4 | 14 | 33 | 122 |
| 1998 | 32 | 4 | 14 | 33 | 83 |
| 1999 | 20 | 4 | 14 | 33 | 71 |
| 2000 | 15 | 4 | 14 | 33 | 66 |
| 2001 | 4 | 1 | 14 | 33 | 52 |
| 2002 | - | 1 | 14 | 33 | 48 |
| 2003 | - | 1 | 14 | 33 | 48 |
| 2004 | - | 1 | 14 | 33 | 48 |
| 2005 | - | - | 14 | 33 | 47 |
| 2006 | - | - | 14 | 33 | 47 |
| 2007 | - | - | 9 | 33 | 42 |
| 2008 | - | - | 8 | 33 | 41 |
| 2009 | - | - | 8 | 33 | 41 |
| 2010 | - | - | 8 | 33 | 41 |
| 2011 | - | - | - | 33 | 33 |
| 2012 | - | - | - | 33 | 33 |
| 2013 | - | - | - | 33 | 33 |
| 2014 | - | - | - | 33 | 33 |
| 2015 | - | - | - | 33 | 33 |
| 2016 | - | - | - | 33 | 33 |
| 2017 | - | - | - | 33 | 33 |
| 2018 | - | - | - | - | - |

The need for new locomotives is dependent on traffic level, operational performance and locomotive availability. Most of the improvements proposed on infrastructure will permit a reduction of travelling times and an increase in the utilisation of locomotives, reducing the need for further locomotive investments.

### 14.2.5.2 Locomotives : Re-Engine

#### 14.2.5.2.1 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 impacting strongly on TDY financial accounts. It is recommended that a programme of conversion of ten 2 TE10M 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 10 locomotives 2TE10*** | ***14.0*** | ***2.8*** | ***4.2*** | ***4.2*** | ***2.8*** | ***-*** |

#### 14.2.5.2.2 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.

### 14.2.5.2.3 Project Case

#### 14.2.5.2.3.1 Impact Of The Project

Due to greater availability 10 re-engined locomotives will replace 12 of the original design. Operational savings will produce an attractive pay-back period of less than three 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* |

#### *14.2.5.2.3.2 Financial evaluation*

The IRR would be 24.92% :

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : S0 | | | | | | | | | | | | | | | | | | |
| Maintenance cost : old | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | 1,53 | |
| Operation cost : old | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | 3,57 | |
| Cash flow | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | -5,10 | **-86,69** |
| Project case : S1 | | | | | | | | | | | | | | | | | | |
| Investments | 2,80 | 4,20 | 4,20 | 2,80 | | | | | | | | | | | | | | |
| Maintenance cost : new | 0,01 | 0,03 | 0,05 | 0,06 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | 0,03 | |
| Maintenance cost : old | 1,27 | 0,89 | 0,38 | 0,00 | | | | | | | | | | | | | | |
| Operation cost :new | 0,41 | 1,03 | 1,64 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | 2,05 | |
| Operation cost :old | 2,98 | 1,79 | 0,89 | 0,00 | | | | | | | | | | | | | | |
| Cash flow | -7,47 | -7,93 | -7,16 | -4,91 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | -2,08 | **-54,54** |
| S1-S0 | -2,37 | -2,83 | -2,07 | 0,19 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | 3,02 | **32,15** |
| IRR | 24,92% | | | | | | | | | | | | | | | | | |

Pay out time would be around 7 years.

### 14.2.5.3 New Locomotives

#### 14.2.5.3.1 Brief Description

There are insufficient modern locomotives to meet the very short term TRACECA fleet recommendation of 90 locomotives (180 units). This figure is in line with the proposed revised operating requirements for main line locomotives. Up to 40 locomotives need to be replaced within the next ten years, the majority being due for replacement in years 6-7.

The introduction of new locomotives would considerably reduce operating and maintenance costs, both by the use of re-engining in existing locomotives, and by the purchase of new locomotives. Nevertheless the age of the existing traction units limits the possibilities, on a short term basis, to re-engine a significant part of the fleet. Therefore it is proposed, to meet fleet requirements, to purchase 8 new diesel freight locomotives on a five year programme.

The need to replace the old locomotives (mainly 2TE10 L, 2TE10 V and 2TE10 M) could be reduced if modern world market single unit locomotives were considered for freight working. Improved reliability would far outweigh the advantage of double units, with much lower running and maintenance costs.

Manufacturers will probably produce the next generation of freight locomotives from 1999. It is recommended that no freight locomotives of the existing design should be purchased, and no new freight locomotives are considered until the new designs have been proven in

service. A provision of $24m is made for the initial purchase of eight new generation freight locomotives as shown in the schedule produced underneath :

| Year | Total | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **Purchase 8 new freight locomotives** | **24.0** | **-** | **6.0** | **6.0** | **6.0** | **6.0** |

Replacing the 2TE10 locomotives with new generation 4000 hp locomotives of the same haulage capacity would give operational savings at least as great as re-engining, but with a longer pay back of 7 years.

### 14.2.5.3.2 Project Case

#### 14.2.5.3.3.1 Impact Of The Project

Three impacts are expected :

- reduction of maintenance cost
- reduction of operation costs (including fuel and lubricants consumption)
- increase of the traffic which can be carried.

No projected maintenance costs are available, but a comparison could be made on overhaul and rebuild costs.

The following comparison, supplied by GM, could be used to obtain comparative costs based on frequency of overhaul, assuming costs the same as the current known 2TE10 costs (although GM costs are probably less):

| | 2TE10 | GM Loc. |
|---|---|---|
| **km. between overhaul** | **240,000** | **1,600,000** |
| **km. between rebuild** | **1,500,000** | **4,800,000** |

Overhaul assumed to equate to TR3 = $ 37,000
Rebuild assumed to equate to a KR = $ 260,000

However it would not be unreasonable to assume similar maintenance costs as in the re-engine proposal, less 20% to allow for new bogies, components etc.

The following comparison of consumption has been supplied by GM:

| Parameter | Unit | 2TE10 | GM Loc. |
|---|---|---|---|
| **Engine model** | | **10D100** | **16-710G3B** |
| **Engine power** | **kW** | **2208 x 2** | **3063** |
| **Tractive effort (cont.)** | **kg** | **24,960 x 2** | **46,340** |
| **Fuel consumption at full power** | **g/kW-hr** | **217.6** | **197.6** |
| **Fuel consumption at idle** | **kg/hr** | **23** | **11.3** |
| **Oil consumption** | **g/kW-hr** | **1.74** | **0.96** |

Annual costs depend on kilometres operated - see below.

However, making use of figures based on the TRACECA R.S. Report:
Average speed : 35 kph
Average hours : 8 per day
Average train load : 3000t
and assuming 6 hr. working full power, 2 hr. idling ,and new locos with 30% greater availability:

| | Unit | 2TE10 | GM Loc. |
|---|---|---|---|
| ***Daily fuel consumption*** | ***kg*** | ***5811*** | ***3654*** |
| ***Daily cost (fuel - $ 150 per tonne)*** | ***$*** | ***871*** | ***548*** |
| ***Annual working days available*** | | ***175*** | ***225*** |
| ***Annual fuel costs*** | ***$*** | ***152,425*** | ***123,300*** |

| | Unit | 2TE10 | GM Loc. |
|---|---|---|---|
| ***Daily lub.oil consumption*** | ***kg*** | ***61.5*** | ***23.5*** |
| ***Daily cost (lub.oil - $ 500 per tonne)*** | ***$*** | ***30.75*** | ***11.75*** |
| ***Annual working days available*** | | ***175*** | ***225*** |
| ***Annual lub.oil costs*** | ***$*** | ***5381*** | ***2644*** |

These figures will of course change based on operational projections for speed and distances.

The new locomotives should have a long term availability of 90%, compared with the current availability of 70%. This alone equates to an increase of 30% in kilometres.
Existing TDY operational locos average 80,000 km per annum ( fleet average 37,000 km. p.a.), thus GM locomotive assumed to operate 105,000 km under current conditions.

Therefore it has been assumed that 8 new locos will replace 11 old locos due the higher availability rate. In terms of operation (mainly fuel and lubricants costs) and maintenance, the cost would be 55% lower with new locos.

#### 14.2.5.3.3.2 Financial Evaluation

The IRR would therefore be 11.47%.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : S0 | | | | | | | | | | | | | | | | | | |
| Maintenance and operatio | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | 4,56 | |
| Cash flow | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -4,56 | -77,59 |
| Project case : S1 | | | | | | | | | | | | | | | | | | |
| Investments | | 6,00 | 6,00 | 6,00 | 6,00 | | | | | | | | | | | | | |
| Maintenance and operatio | 4,56 | 3,73 | 2,49 | 1,24 | | | | | | | | | | | | | | |
| Maintenance and operatio | 0,00 | 0,37 | 0,75 | 1,12 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | 1,49 | |
| Cash flow | -4,56 | -10,11 | -9,24 | -8,37 | -7,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | -1,49 | 2,73 | -53,47 |
| Residual value | 0,00 | 0,42 | 0,84 | 1,27 | 1,69 | | | | | | | | | | | | | 4,22 |
| S1-S0 | 0,00 | -5,54 | -4,67 | -3,80 | -2,93 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 3,07 | 7,29 | 24,12 |
| IRR | 11,47% | | | | | | | | | | | | | | | | | |

Pay-off time would be about 10 years.

### 14.2.5.4 Upgrading Of Maintenance Equipment And Facilities

#### 14.2.5.4.1 Brief Description

Four fields of investment are required :

| *Year* | *Total* | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|---|
| ***Upgrade loco workshops*** | ***4.0*** | ***2.0*** | ***2.0*** | ***-*** | ***-*** | ***-*** |
| ***Upgrade coach workshops*** | ***2.0*** | ***1.0*** | ***1.0*** | ***-*** | ***-*** | ***-*** |
| ***Upgrade wagon workshops*** | ***4.0*** | ***1.0*** | ***1.5*** | ***1.5*** | ***-*** | ***-*** |
| ***Spares stock*** | ***3.0*** | ***1.5*** | ***1.5*** | ***-*** | ***-*** | ***-*** |

**Locomotive depots and workshops**
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$ 2 m of parts will be required.
KR1 facilities should be implemented at Ashgabat Locomotive Depot. They are estimated at US$ 4m for equipment and for workshop changes. They include :

- Hydraulic press for wheel-sets
- Axle lathe
- Vertical boring mill
- Tyre shrinking equipment
- Jigs and stands for engine overhaul
- Jigs and stands for engine component overhaul
- Machine tool replacement programme

**Wagon workshops**
Improvements on wagon workshops are set at 4 MUSD.

**Coaches workshops**
A satisfactory stock of spare parts is needed to carry out satisfactorily the works without any interruption to the work flow. A stockholding of around US$ 1.0 m will be required to be held at all times.

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 $ 2m.

#### 14.2.5.4.2 Base Case

The base case was considering that major repairs would still be carried out of Turkmenistan.

#### 14.2.5.4.3 Project Case

##### 14.2.5.4.3.1 Impact Of The Project

*Loco Workshops*

The principal result of the loco workshop expenditure will be to enable TDY to undertake major repairs (KR) within Turkmenistan. At present this work is well behind schedule because of lack of hard currency (see report).

If all the work was carried out abroad on the envisaged future fleet the costs are estimated as follows, for the envisaged fleet:

90 main line locos, KR every 4.5 years - On-going requirement 20 KR p,a, @ $ 260,000 each. (This figure could be on the low side.)

60 shunting locos, KR every 7.5 years.- On-going requirement 8 KR p.a. @ $ 150,000 each. Mark ups of 100% for repairs abroad, due to lack of competition have been mentioned and in addition there are haulage costs to be reckoned with.

TDY should also be more efficient in overhauling their own equipment. It is not unreasonable to assume that cost savings of 50% could be made by in-house overhauls, that is if instead of deferral, the work was being carried out- which it eventually must be, otherwise the railway will grind to a halt.

*Passenger Workshops*

As with the loco expenditure, the principal result will be to enable TDY to undertake major repairs (KR) within Turkmenistan. This work is also behind schedule due to lack of hard currency. It is understood that TDY do not envisage further expenditure on new coaches, and it is assumed that all existing coaches will have to be maintained. Fleet size 300, KR every 5 years - on-going requirement 60 KR p.a. @ $29,000 each. Again it is reasonable to assume that 50% savings could be made in house.

*Wagon Workshops*

The need arises for the expenditure mainly to replace worn out equipment and life expired facilities to enable wagon maintenance to continue. TDY already have the capacity between Gyzlarbat Works and Carjew Depot to carry out all KR wagon overhauls in house, (approx. 1000 p.a.). It is difficult to make a financial case for expenditure which is required anyway to replace worn out assets, and for health, safety, and environmental, grounds.

*Benefits of purchase of spare parts*

The need arises to ensure that work can proceed on major overhauls without disruption by having a stockholding of parts at hand, and as such the costs should be incorporated in the evaluation of the above loco and coach workshops expenditure to make provision for KR overhauls.

No measurement of downtime due to current failures and breakdown caused by the non-availability of parts is available, so it is difficult to quantify the benefits on current operations, which there undoubtedly will be.

The development of major repairs operations in Turkmenistan will permit less staff reductions in TDY. Social benefits were not included in the evaluation.

#### 14.2.5.4.3.2 Financial Evaluation

The evaluation on a ten year basis (without including the residual value of investments which is difficult to assess considering the different nature of these) shows an IRR of 29,28%. The pay off time is assumed to be 5 years.

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Base case : S0 | | | | | | | | | | | | |
| Maintenance cost : locos | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | 6,40 | |
| Maintenance cost : wagons | | | | | | | | | | | | |
| Maintenance cost : coach | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | 1,74 | |
| Cash flow | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | -8,14 | **-89,54** |
| | | | | | | | | | | | | |
| Base case : S1 | | | | | | | | | | | | |
| Investments | 5,50 | 5,50 | 1,50 | | | | | | | | | |
| Maintenance cost : locos | 6,40 | 4,80 | 4,00 | 3,20 | 3,20 | 3,20 | 3,20 | 3,20 | 3,20 | 3,20 | 3,20 | |
| Maintenance cost : wagons | | | | | | | | | | | | |
| Maintenance cost : coach | 1,74 | 1,31 | 1,09 | 0,87 | 0,87 | 0,87 | 0,87 | 0,87 | 0,87 | 0,87 | 0,87 | |
| Cash flow | -13,64 | -11,61 | -6,59 | -4,07 | -4,07 | -4,07 | -4,07 | -4,07 | -4,07 | -4,07 | -4,07 | **-64,39** |
| | | | | | | | | | | | | |
| S1-S0 | -5,50 | -3,47 | 1,55 | 4,07 | 4,07 | 4,07 | 4,07 | 4,07 | 4,07 | 4,07 | 4,07 | **25,15** |
| | | | | | | | | | | | | |
| IRR | 29,28% | | | | | | | | | | | |

The real results should be better than these produced here as benefits produced from the improvement of the wagon workshop and the purchase of spare parts could not be estimated and therefore were not taken into account.

## 14.2.6 MIS

MIS investments will be provided through Japanese funds and there will be no need at present stage for further investments.

# 15 Business Plan 1998 -2002

## 15.1 Introduction

The preparation of the corporate business plan is a process that should involve all of the managers in TDY. It is through the participation in the planning process that managers begin to understand the way the company functions, its strengths and weaknesses, and the opportunities and threats that exist in the business environment.

The business plan provides TDY with a means of demonstrating to the state and the Cabinet of Ministers that unless it begins the process of rationalisation now, including the elimination of unprofitable services, its financial situation will deteriorate. TDY needs the moral support of the state in implementing the restructuring plans and it is hoped that this can be achieved through the presentation of a logical business plan.

The business plan also provides TDY with a means of communicating with lending agencies and regulatory bodies. Through the business plan TDY can demonstrate the impact of specific action plans, for example staff reductions, locomotive replacement, revised operating procedures. It is important that TDY prepares its business plan in an integrated manner, so that it not only addresses the revenues and costs contained in the income statement, but also the funding requirements as highlighted in the cash flow and its overall financial position as shown in the projected balance sheets.

The business plan that follows is an illustration of the financial outcome of the specific recommendations contained in the separate reports on the passenger, freight, rolling stock and infrastructure business units. Detailed projected cost statements are provided for each business unit as part of the plan working papers.

### 15.1.1 The Impact Of Effective Management *Information Systems On The* Businesses

Currently in TDY, little exists in the way of automated information systems. When TDY begins to design and implement new systems to meet the management requirement aligned to a changing market economy, that which does exist should not be dispensed with. The present systems, which provide traffic information, can be enhanced and built on. Those areas where nothing exists can be given priority when new systems are being developed. In modern market economies supplies and demands constantly and quickly change and management needs to respond to such change in a way that will protect their business and profits. This situation requires accurate and timely financial information for all levels of management and it is considered that TDY should first concentrate in the financial area by starting to build a comprehensive and integrated management information system.

Installation of modern information systems will bring significant savings and efficiencies. TDY's current management practice is supported for the most part by paper based systems which are labour intensive and un-responsive in terms of reporting and presentation of information. The modest level of computerisation in TDY and the batch processing nature of its core systems suggests that substantial benefits and savings can be achieved by investing in modern hardware and software systems. The move to online systems and data capture at source will eliminate most of the paper based processes and time delays inherent in the present procedures. The processing and printing of reports on demand locally will speed up access to information and free resources for more productive activities, as well as providing facilities for controlling and monitoring the performance of the individual businesses, and providing a sound basis on which effective management decisions can be made.

As pointed out in Section 14, the required investment in information technology, computerisation, and management information systems, amounting to 9.767m$ over a five year period can be catered for under the provisions of the Japanese loan already negotiated by TDY, which has an allocation for equipping the newly constructed computer building in Ashgabat.

## 15.2 Mission Statement

TDY sets out to be a modern competitive railway, growing its market share and fulfilling its role as a key element of the national transport infrastructure. TDY aims to satisfy its customers' needs by providing a national rail transport service that is safe, customer oriented, reliable, competitive and cost effective.

## 15.3 General Objectives And Goals

TDY's general objectives and goals will be to :

- Develop the new state / railway relationship and introduce the Performance Agreement.
- Implement the management restructuring, put the new management organisation in place, and develop the Business and Service Units
- Develop a new commercially oriented management style focused on profitable traffics, fulfilling customer needs, and on reducing costs.
- Develop marketing concepts for the principal commodity traffics.

## 15.4 Strategic Objectives

### 15.4.1 Passenger Business Unit

The increase in tariffs in December 1996 led to a significant decline in the numbers of passengers travelling by rail, indicating a very sensitive market. The decline in numbers has "bottomed out" by the end of 1997 and TDY's strategic objective will be to restore the 1996 passenger traffic levels by developing and introducing :

- rescheduled passenger services
- shorter journey times
- Intercity branded trains between main centres
- regional trains consisting of a mix of sleeper and open seat coaches
- upgraded passenger coaches with better standard of comfort
- reduced number of stations and stops
- tariff levels that will meet the costs and expenditure
- state support for services that are not profitable

### 15.4.2 Freight Business Unit

Trends in rail traffic show that the drastic fall in freight traffic in Turkmenistan up to the end of 1995 has now ceased and in 1996 and in the first eight months of 1997, volumes have stabilised and are even showing a slight increase.

The TDY Freight Business Unit will aim to :

- increase its market share by at least 2% per annum over the next five years and to step this up by 3.5% per annum between five and ten years to achieve 9,507 million tonnes km. in 2007.

- develop procedures of management, administration and operation and implement the new management structures to improve the operation of the freight business. TDY will create regional freight centres, develop a forwarding network, and train sales agents.
- develop a marketing strategy geared to achieving the annual growth outlined above, while at the same time setting its tariffs to ensure that TDY's revenue adequately covers its costs and allows for its profit.
- increase the speed of freight trains to 80kph immediately and after upgrading of track and acquisition of new locomotives to 100kph.
- introduce freight train timetables to operate trains between principal marshalling yards of Turkmenbashi, Ashgabat, and Chardjev.
- introduce block train working for cement and oil traffic
- improve locomotive and locomotive crew productivity.
- close Annew yard and reduce trackage and sidings in stations and yards where possible
- develop combined transport and containerisation which is likely to be a key aspect of rail freight traffic in TDY

### 15.4.3 Infrastructure Business Unit

The existing track conditions are reasonably good for the present line speeds, particularly where concrete sleeper track and continuously welded rail conditions exist. The main problem areas relate to replacement of timber sleepers, and improving the ballast conditions on the track system generally. The Infrastructure Service Unit will have the following primary objectives :

TRACK

- Upgrade track to accommodate increased line speeds for freight and passenger trains.
- Phase out timber sleeper track in main line by acquisition of sleeper changing machines and equipment.
- Improve concrete sleeper factory in Ashgabat to allow for increased annual production of sleepers and to commence the manufacture of concrete bearers for points and crossings.
- Improve points and crossing maintenance by introducing high quality welding repairs to steelwork.
- Improve production facilities in stone ballast quarries to provide well graded ballast.
- Provide additional ballast hopper wagons to effect the efficient distribution of ballast in track to the required depth and profile.
- Purchase a modern ballast cleaning machine to improve existing ballast conditions.
- Introduce mechanised track maintenance system by acquiring 5 tamping / lining machines, and 3 ballast regulators to provide a uniformly good standard of track maintenance on all main lines.
- Introduce a mobile gang manning system to back up the mechanised track maintenance.
- Effect a significant reduction in the staffing / manning levels on track maintenance and renewals.

SIGNALLING AND TELECOMMUNICATIONS

- Use approved investment finance to acquire backlog of spare parts, tooling and instrumentation.
- Replace priority radio equipment , and modernise telecommunications installations at Bamy, Mary and Dushak.

### 15.4.4 Rolling Stock Business Unit

The TDY Rolling Stock Service Unit plans to work closely with the Passenger and Freight Business Units in the introduction of new train operating procedures, new timetables, new locomotive crew links and improved rolling stock utilisation. The key objectives will be :

- The acquisition of 8 new single unit 3,000 hp freight locomotives to replace the 2 TE 10 units.
- The re-engining of 20 TE 10 units to provide 10 freight locomotives with improved haulage capability and more efficient characteristics.
- Conduct negotiations with a view to getting agreement on a change in the CIS wagon regulations, so that the service life of wagons can be extended depending on their usage and condition rather than their age, to enable investment in new wagons to be deferred.
- Carry out all heavy overhauls of locomotives in Ashgabat Locomotive Workshop, upgrading the equipment and facilities as required.
- Upgrading coach workshops at Ashgabat to facilitate carrying out all major coach repairs there, and to improve the quality and comfort of passenger coaches.
- Concentrate the repair, maintenance, and heavy overhaul of wagons on Gyzlarbat Works and Cardjev Depot.

## 15.5 Financial Forecasts

### 15.5.1 Introduction

Financial forecasts, reflecting optimistic and pessimistic traffic scenarios, have been prepared for Turkmenistan Railways covering the period 1997 to 2007. For simplicity the financial forecasts have been prepared in constant prices thereby eliminating the effects of inflation.

The basis for the expenditure forecast was the actual results for the first six months of 1997 which were grossed up to provide an estimate of the full year.

The revenue forecasts exclude the impact of the hard currency fund which was discussed at length in section 6 of this report. The forecasts therefore attempt to show the potential revenue that TDY could earn rather than the revenue that is reported in the accounts.

### 15.5.2 Profit & Loss (Optimistic Forecasts)

#### 15.5.2.1 Revenue Forecasts

**Freight Traffic**

Freight Traffic is projected to grow by 2% per annum from 1998 to 2001 and by 3.5% per annum from 2002 to 2007. Freight Tonne Kilometres grow from 7,143 million in 1997 to 9,504 million in 2007. Freight Tonnes transported grow from 16.2 million tonnes per annum to 21.6 million tonnes in 2007.

Inflation increases in 1997 have resulted in an average tariff per tonne kilometre that is approximately 70% higher than the average for 1996. It has been assumed that under the optimistic scenario prices rise in real terms by 1% above the rate of inflation during the period 1998 to 2007. TDY's apparent revenue from freight traffic is significantly higher than its costs of transportation. However, TDY does not receive most of this revenue as it is diluted by the effects of the hard currency fund, barter transactions, and transportation of goods for government ministries who do not pay in cash.

It has been assumed that approximately 40% of TDY's revenue is paid for in the form of barter goods. TDY must reduce the amount of barter transactions in order to generate more cash and improve its cash position. It has been assumed that barter transactions are gradually scaled down from 40% in 1997 to 35% in 1998 and by 5% each year until they reach 15% in 2002. It has been assumed that they remain at this level until 2007.

It has been assumed that barter conversion costs are in the order of 20%. Based on some of the transactions outlined by TDY to the consultants this is a conservative estimate. Although the overall level of barter transactions is assumed to reduce it has been assumed that barter transaction costs remain at the same level.

TDY does not provide for bad debts in its accounts. It has been assumed that TDY's bad debts are in the order of 20% and it has been assumed that this can be reduced to 15% for the year 1999 and 2000, and to 10% for the years 2001, 2002, 2003 and to 5% for the year 2004 to 2007.

TDY has been increasing its tariffs, particularly those charged to cash paying customers, in an attempt to generate sufficient cash to meet its daily cash needs.

**Passenger Traffic**

In 1996 TDY reported that its passenger traffic amounted to 2,104 million passenger kilometres. In 1997 passenger traffic declined dramatically and it is assumed that this is a reaction to price increases which have made train travel very expensive relative to other modes. In preparing the optimistic forecasts it has been assumed that passenger traffic will decline by a further 15% in 1998 and begin to recover in 1999. Even under the optimistic scenario passenger traffic does not recover to the 1996 levels during the period covered by the forecasts. These assumptions are consistent with the traffic forecasts contained in the economics sections of this report.

Revenue per passenger kilometre in 1997 was 28.3 manats and it has been assumed that tariffs will increase by 1% per annum in the period up to 2007. Total passenger revenue will increase from 20,829 million manats in 1997 to 79,698 million manats in 2007 largely as a result of the return of passenger traffic that was lost in 1997 following price increases.

**Auxiliary Income**

Net Auxiliary income is projected to remain stable in constant terms up to 2007.

**Net Other Income**

Net Other income is projected to remain stable in constant terms up to 2007.

### 15.5.2.2 Expenditure Forecasts

**Staff Costs**

The most significant single change in TDY during the next ten years will be the restructuring of the organisation and the reduction in the number of staff employed. The number of people employed in the core railway transportation activity is shown as declining from 19,035 in 1997 to only 7,246 in the year 2007. Initially the staff reduction process will be gradual with an average reduction of 6.5 % per annum in 1998 and 1999. The major restructuring effort will be concentrated on the years 2000 to 2002 when the percentage staff reductions will be 19.6%, 16.2% and 16.2 % respectively. Reductions in the years 2003 to 2007 will be more modest.

As restructuring and staff reductions will need to be accompanied by retraining and the redistribution of workloads then it has been assumed that the remaining staff will be compensated by wage increases in excess of the level of inflation. It has been assumed that wage levels will increase by 10% per annum in real terms in the period 1998 to 2002 and by 5% per annum in the period 2003 to 2007.

As can be seen from the analysis tables that form part of this report the reductions in staff are spread evenly across the railway operating units. Despite the assumed increases in real wages staff costs fall by 22% between 1997 and 2007.

**Social Insurance Payments**

Social Insurance payments are calculated as a proportion of the wages costs and equate to approximately 30% of the total wages bill. In the forecasts social insurance costs have been assumed to fall in line with the total wages costs of TDY.

**Consumption Fund & Development Fund Payments**

These items of expenditure are currently treated as distributions of profits by TDY but for the purpose of the analysis of TDY's profitability they have been treated as normal expenditure. They have been assumed to vary in line with the numbers of staff employed in the core transportation activity and so these costs also decline during the period of the forecasts.

**Materials**

The Locomotive Department accounts for 72% of the expenditure on materials in the TDY accounts. The materials expenditure of this department has been assumed to vary in line with the number of diesel locomotives required for operations (50%) and also with the number of traffic units i.e. freight tonne kilometres and passenger kilometres (50%). Current locomotive utilisation, as judged by the average number of locomotive kilometres per unit in service, is low. It has been assumed that locomotive kilometres per unit in service will rise from its current level of approximately 62,000 km per annum to a more realistic 100,000 km per unit due to the purchase of 8 new locomotives and the installation of new engines in 10 of the existing locomotives. This will improve fleet reliability and availability. The materials expenditure of the Locomotive department is assumed to decline initially due to the reduction in the number of locomotives required for service but it increases gradually from 2001 onwards as a result of traffic growth.

The Track Department accounts for 13% of the current materials expenditure according to the TDY accounts. Expenditure in this area has been assumed to remain constant in real terms during the period of the forecasts.

**Fuel**

Expenditure on fuel increases from 20,085 million manats in 1998 to 23,870 million manats in 2007 largely due to the increases in the volume of freight traffic transported. The use of new more fuel efficient locomotives and re-engined locomotives offsets the full impact of the fuel increase. Improved fuel efficiency in 1999, 2000, and 2001 results in an assumed reduction of 15% in traction fuel usage by the Locomotive Unit which is the main consumer of fuel in TDY.

**Power Supply**

Power Supply costs decline throughout the period of the forecast. Power consumption in the Freight & Commercial Unit is assumed to vary with the volume of freight traffic, i.e. the main activity of the unit. The increase in the power consumption by this department is assumed to be offset by reductions in consumption by other departments of the railway where consumption is believed to vary in line with the number of staff employed.

**Repair Fund & Other Costs**

Expenditure in this area is assumed to remain reasonably stable during the period of the forecasts.

### Bad Debts

The provision for bad debts has been included as a memo item in the financial forecasts. TDY currently makes no provision for this cost. It has been assumed that TDY's annual bad debt provision should be approximately 20% of its freight revenue. It has also been assumed that TDY can influence this situation and reduce its bad debts provision to 15% of freight revenue in 1999 and 2000, to 10% in 2001, 2002 and 2003, and then to 5% from 2004 onwards.

### Barter Conversion Costs

TDY pays more for goods that it receives in barter transactions than it would if it paid in cash. In many cases TDY has very little control over these types of transactions. For the purpose of the forecasts it has been assumed that TDY will continue to pay a premium of 20% on items received in the form of barter goods during the period of the forecasts. The total amount incurred as barter transaction costs declines in the forecast due to a reduction in the amount of revenue that is assumed to be received in the form of barter goods as TDY begins to insist on payment in cash.

### Social Needs Expenditures

This item of expenditure is currently treated as a distribution of profits by TDY. For the purpose of the preparation of financial forecasts, social needs expenditures have been treated as an operating expenditure. The total amount of expenditure in this area is assumed to vary with the number of staff employed and so it is assumed to decline throughout the period of the forecasts.

### Total Operating Expenses

Total operating expenses, before depreciation, have been projected to decline from 228,783 million manats in 1997 to 163,404 million manats by the year 2007 a reduction of 29%.

### Operating Profit Before Depreciation

Growing revenue and declining operating costs result in a growth in operating profit throughout the period of the forecasts. The bulk of the decline in operating costs, however, is accounted for by reductions in bad debts provision, reduced barter conversion costs and lower social needs expenditures. These are items that require management attention if TDY's financial position is to be improved.

### Replacement Cost Depreciation

In section 6 of this report the replacement cost depreciation calculation was discussed. The same basis of calculation has been used in the forecasts to reflect the true depreciation figure that should be included in the TDY accounts if it is to generate sufficient profits to be in a position to replace its assets from its own resources. The annual replacement cost depreciation charge is highlighted in the forecast income statements.

### Operating Profit after Replacement Costs Depreciation

The size of the replacement cost depreciation provision has the effect of producing very large book losses in TDY's accounts. As revenue grows and costs reduce the size of the loss decreases until by the year 2005 TDY is generating sufficient profits to cover its full replacement cost depreciation figure. As can be seen from the summary income statement TDY needs to have an operating ratio of almost 60% (before depreciation) to produce a post depreciation profit. This is an indication of the extent to which the price and cost structure of TDY are out of line with price levels in Western Europe.

**Interest on Loans**

The interest amount shown in the profit and loss account reflects the payment of interest on the Japanese loan and an additional loan of $56.4 million dollars taken out to cover the investment programme recommended by the consultants. It has been assumed that TDY or the government of Turkmenistan will fund the balance of $37.6 million dollars needed to finance the total investment package.

**Profit/(Loss) before Tax**

TDY does not generate an accounting profit in the forecasts after payment of interest on loans.

**Taxation**

It has been assumed that TDY will be not be allowed to deduct Consumption Fund Payments, Development Fund Payments, Social Needs expenditure or Replacement Costs Depreciation in the calculation of taxable profits. Therefore, despite generating accounting losses TDY will still face a tax burden throughout the period of the forecasts.

## 15.5.3 Cash Flow Forecasts (Optimistic)

The cash flow forecasts prepared for TDY reflect a steadily improving cash inflow position due largely to growth in freight and passenger revenues. Auxiliary income and other income have been assumed to remain constant throughout the forecast. It has been assumed that TDY will make efforts to reduce its accounts receivable balance by 20,000 million manats per annum in the period 1997 through 2000. Receipt of loan funds in the years 1998 through 2002 also boost the cash balance.

The two main cash outflows are the payment of operating expenses and the projected expenditure on capital investment. Operating expenses decline throughout the period of the forecast largely due to the projected reductions in staff numbers. Capital expenditure in the years 1998 through 2002 reflects the investments funded by the Japanese loan and the investment programme identified by the consultants. It has also been assumed that TDY will reduce its accounts payable balance which has been allowed to accumulate as a result of its commitment to the construction of new railway lines.

TDY has been investing in the construction of new railway lines and an amount of 50,000 million manats has been included in the cash flow projection for 1997 to reflect this. The cash flow forecasts prepared by the consultants exclude expenditure of this nature after 1997.

In the projections prepared by the consultants TDY generates cash surpluses. These can be used to fund the development of viable investment projects identified by the railway which produce a financial return. By the year 2007 TDY should have generated 715,032 million manats in cash surpluses ( approximately 143 million dollars at an exchange rate of 5,000 to US$ 1).

It should be noted that TDY is not committed to making any capital repayment on its Japanese loan until 2008 and it has been assumed that the same grace period applies to the loans taken out to fund the new investment programme.

## 15.5.4 Balance Sheets (Optimistic)

TDY's assets are undervalued at present even though there was a revaluation of fixed assets in April 1996. The growth in fixed assets in the projected balance sheets is the result of the capital investment programme. Capital work in progress has been treated as part of fixed assets for the purpose of preparing these projections.

Current assets grow dramatically throughout the period of the forecast due to the large cash surpluses being generated. These are assumed to be available for investment by TDY in projects which are as yet unidentified. Accounts receivable levels are assumed to decline as a result of management action by TDY. Inventory levels have been held constant in the forecasts.

The analysis of the current financial situation revealed very high levels of accounts payable and accruals. It has been assumed that TDY will make efforts to reduce the amount due in the period up to 2001.

Long terms loans increase up to 2001 as a results of the amounts provided to TDY under the terms of the Japanese loan and other loans to fund the current investment programme. These stabilise in 2001 and are not reduced thereafter as TDY is not committed to making capital repayments during the period of the forecasts.

Capital and Reserves increase through the period. A new account < Replacement Cost Depreciation Reserve > has been included in this section to reflect the excess of historical cost depreciation over replacement cost depreciation. This reserve has the effect of balancing out the negative impact of the accumulated accounting losses that are generated in the profit and loss account as a result of charging depreciation at replacement cost levels.

### 15.5.5 TDY Financial Projections (Pessimistic)

A set of financial projections have been prepared which use the pessimistic freight and passenger traffic projections contained in the economic analysis section of this draft final report. All of the costs assumptions have been left unaltered so the variations in the profit & loss account, cash flow statements and balance sheets are attributable to reductions in freight and passenger traffic volumes and revenue.

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**OPERATING STATISTICS**

| | Actual 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Key Assumptions** | | | | | | | | | | | | |
| Inflation rate [relates current to previous year's expenses] | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Key Operating Statistics** | | | | | | | | | | | | |
| Freight tonnes (000) | 15,903 | 16,221 | 16,545 | 16,876 | 17,214 | 17,558 | 18,173 | 18,809 | 19,467 | 20,148 | 20,854 | 21,584 |
| Freight tkm (000,000) | 7,003 | 7,143 | 7,286 | 7,431 | 7,580 | 7,732 | 8,002 | 8,282 | 8,572 | 8,872 | 9,183 | 9,504 |
| Ave. length of haul | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 |
| Passenger km (000,000) | 2,104 | 954 | 813 | 831 | 903 | 982 | 1,123 | 1,268 | 1,419 | 1,575 | 1,736 | 1,903 |
| Locomotive km (000) | 6,998 | 7,092 | 7,187 | 7,284 | 7,383 | 7,484 | 7,665 | 7,851 | 8,045 | 8,245 | 8,452 | 8,666 |
| Train km (000) | 6,998 | 7,092 | 7,187 | 7,284 | 7,383 | 7,484 | 7,665 | 7,851 | 8,045 | 8,245 | 8,452 | 8,666 |
| Wagon km (000,000) | 226 | 230 | 235 | 239 | 244 | 249 | 258 | 267 | 276 | 286 | 296 | 306 |
| Employment - core activity | 19,230 | 19,035 | 17,789 | 16,625 | 13,373 | 11,203 | 9,387 | 8,995 | 8,644 | 8,316 | 7,900 | 7,246 |
| Percentage change | | -1.0% | -6.5% | -6.5% | -19.6% | -16.2% | -16.2% | -4.2% | -3.9% | -3.8% | -5.0% | -8.3% |

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**PROFIT AND LOSS ACCOUNT 1996 - 2007**
**(All Data is in Millions of Manats)**

| | Actual 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Operating Revenue** | | | | | | | | | | | | |
| Freight Business | 137,854 | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 281,460 | 294,224 | 307,567 | 321,515 | 336,096 | 351,338 |
| Passenger Business | 7,544 | 26,995 | 23,235 | 23,987 | 26,325 | 28,915 | 33,395 | 38,083 | 43,041 | 48,249 | 53,717 | 59,479 |
| Auxilliary Activities Income | 8,720 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 |
| Other Income | 1,240 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 |
| Total Operating Revenue | 155,358 | 278,592 | 282,051 | 290,240 | 300,240 | 310,722 | 327,412 | 344,865 | 363,166 | 382,323 | 402,371 | 423,375 |
| Operating Subsidy | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Operating Revenue | 155,358 | 278,592 | 282,051 | 290,240 | 300,240 | 310,722 | 327,412 | 344,865 | 363,166 | 382,323 | 402,371 | 423,375 |
| **Operating Expenses** | | | | | | | | | | | | |
| Salary - per accounts | 13,467.0 | 28,292.0 | 29,071.9 | 29,888.7 | 26,439.6 | 24,366.3 | 22,463.0 | 22,611.3 | 22,815.4 | 23,043.0 | 22,987.2 | 21,986.8 |
| Social Insurance | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| - Consumption Fund Payments | 5,940 | 15,000 | 14,018 | 13,101 | 10,538 | 8,828 | 7,397 | 7,088 | 6,812 | 6,553 | 6,225 | 5,710 |
| - Development Fund Payments | 786 | 7,000 | 6,542 | 6,114 | 4,918 | 4,120 | 3,452 | 3,308 | 3,179 | 3,058 | 2,905 | 2,665 |
| Materials | 10,043 | 24,128 | 23,445 | 22,945 | 21,960 | 21,919 | 22,412 | 22,968 | 23,542 | 24,136 | 24,746 | 25,377 |
| Fuel | 10,185 | 20,088 | 20,085 | 19,496 | 18,991 | 18,516 | 19,300 | 20,151 | 21,034 | 21,948 | 22,892 | 23,870 |
| Electrical power supply | 1,365 | 3,982 | 3,941 | 3,903 | 3,783 | 3,700 | 3,628 | 3,618 | 3,608 | 3,600 | 3,589 | 3,579 |
| Repair Fund & Other operating expenses | 30,446 | 41,926 | 41,213 | 40,563 | 39,620 | 39,238 | 39,254 | 39,497 | 39,751 | 40,020 | 40,285 | 40,565 |
| Bad Debt | 0 | 47,808 | 49,252 | 38,054 | 39,203 | 26,925 | 28,146 | 29,422 | 15,378 | 16,076 | 16,805 | 17,567 |
| Barter Conversion | 0 | 19,123 | 17,238 | 15,222 | 13,068 | 10,770 | 8,444 | 8,827 | 9,227 | 9,645 | 10,083 | 10,540 |
| Social Needs Expenditures | 1,351 | 13,000 | 12,149 | 11,354 | 9,133 | 7,651 | 6,411 | 6,143 | 5,903 | 5,679 | 5,395 | 4,949 |
| Total Operating Expenses | 77,357 | 228,783 | 225,676 | 209,607 | 195,586 | 173,344 | 167,646 | 170,417 | 158,094 | 160,672 | 162,809 | 163,404 |
| Operating Profit Before Depreciation | 78,001 | 49,808 | 56,375 | 80,633 | 104,654 | 137,378 | 159,766 | 174,448 | 205,073 | 221,651 | 239,562 | 259,971 |
| Depreciation | 11,875.0 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 233,244 | 235,787 | 238,367 | 239,456 | 240,579 | 241,742 |
| Operating Profit | 66,126 | -198,140 | -185,962 | -156,758 | -126,958 | -93,413 | -73,477 | -61,339 | -33,294 | -17,806 | -1,016 | 18,229 |
| Interest - Loans | - | - | 2,700 | 14,485 | 18,234 | 20,502 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 |
| Interest - Bank Borrowings | - | - | - | - | - | - | - | - | - | - | - | - |
| Extraordiary Items | 101,188 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit / (Loss) before tax | -35,062 | -198,140 | -188,662 | -171,243 | -145,192 | -113,915 | -95,743 | -83,605 | -55,560 | -40,072 | -23,282 | -4,037 |
| Tax | 9,390 | 33,676 | 27,582 | 27,563 | 32,508 | 36,896 | 42,425 | 46,766 | 51,295 | 56,026 | 61,111 | 66,827 |
| Profit Retained | -44,452 | -231,816 | -216,244 | -198,806 | -177,700 | -150,811 | -138,168 | -130,371 | -106,856 | -96,098 | -84,393 | -70,864 |
| | | | | | | | | | | | | |
| Operating Profit before Depreciation % | 50.2% | 17.9% | 20.0% | 27.8% | 34.9% | 44.2% | 48.8% | 50.6% | 56.5% | 58.0% | 59.5% | 61.4% |

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**CASH FLOW STATEMENT 1997 - 2007**
**(All Data is in Millions of Manats)**

| | | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RECEIPTS** | | | | | | | | | | | | |
| Freight Revenue | | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 281,460 | 294,224 | 307,567 | 321,515 | 336,096 | 351,338 |
| Passenger Revenue | | 26,995 | 23,235 | 23,987 | 26,325 | 28,915 | 33,395 | 38,083 | 43,041 | 48,249 | 53,717 | 59,479 |
| Auxiliary Activity Income | | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 |
| Other Revenue | | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 |
| Operating Subsidy | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decrease in Accounts Receivable | | 20,000 | 20,000 | 20,000 | 20,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital Grant - Repayment of Loans | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Grants | | | | | | | | | | | | |
| Loans received | | 0 | 163,270 | 187,040 | 62,490 | 37,800 | 29,400 | 0 | 0 | 0 | 0 | 0 |
| Total | 0.0 | 298,592 | 465,321 | 497,280 | 382,730 | 348,522 | 356,812 | 344,865 | 363,166 | 382,323 | 402,371 | 423,375 |
| **PAYMENTS** | | | | | | | | | | | | |
| Operating Expenses | | 228,783 | 225,676 | 209,607 | 195,586 | 173,344 | 167,646 | 170,417 | 158,094 | 160,672 | 162,809 | 163,404 |
| Increase in Inventory | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decrease in Accounts Payable | | 0 | 0 | 10,000 | 30,000 | 55,000 | 60,000 | 20,000 | 0 | 0 | 0 | 0 |
| Capital Investment | | 50,000 | 205,450 | 246,400 | 104,150 | 63,000 | 49,000 | 0 | 0 | 0 | 0 | 0 |
| Interest - Loans | | 0 | 2,700 | 14,485 | 18,234 | 20,502 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 |
| Loan Repayments | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Interest - Bank Borrowings | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit Tax Paid | | 27,605 | 29,106 | 27,568 | 31,272 | 35,799 | 41,043 | 45,681 | 50,163 | 54,843 | 59,840 | 65,398 |
| Total | 0.0 | 306,388 | 462,932 | 508,059 | 379,242 | 347,645 | 339,955 | 258,364 | 230,523 | 237,781 | 244,914 | 251,068 |
| Cash Increase / (Decrease) | 0 | -7,796 | 2,389 | -10,779 | 3,488 | 878 | 16,858 | 86,501 | 132,644 | 144,541 | 157,457 | 172,307 |
| Balance Previous Year | | 16,544 | 8,748 | 11,137 | 358 | 3,846 | 4,724 | 21,582 | 108,083 | 240,727 | 385,268 | 542,725 |
| Cash at Year End | 0 | 8,748 | 11,137 | 358 | 3,846 | 4,724 | 21,582 | 108,083 | 240,727 | 385,268 | 542,725 | 715,032 |
| Annual Interest Rate | | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| Debt Service Coverage (Times) (Available Cash/Interest Payments) | | | 0.9 | -0.7 | 0.2 | 0.0 | 0.8 | 3.9 | 6.0 | 6.5 | 7.1 | 7.7 |

TURKMENISTAN RAILWAYS
OPTIMISTIC SCENARIO
BALANCE SHEET 1996 - 2007
(All Data is in Millions of Manats)

| | Estimated 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixed Assets** | | | | | | | | | | | | |
| Gross Fixed Assets & Capital WIP | 831,976 | 881,976 | 1,087,426 | 1,333,826 | 1,437,976 | 1,500,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 |
| Less: Depreciation | 430,260 | 456,719 | 489,342 | 529,357 | 572,496 | 617,525 | 664,025 | 710,524 | 757,023 | 803,523 | 850,022 | 896,521 |
| Net Fixed Assets | 401,716 | 425,257 | 598,084 | 804,469 | 865,480 | 883,451 | 885,951 | 839,452 | 792,953 | 746,453 | 699,954 | 653,455 |
| Financial Long Term Assets | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total Fixed Assets | 401,717 | 425,258 | 598,085 | 804,470 | 865,481 | 883,452 | 885,952 | 839,453 | 792,954 | 746,454 | 699,955 | 653,456 |
| **Current Assets** | | | | | | | | | | | | |
| Cash | 16,544 | 8,748 | 11,137 | 358 | 3,846 | 4,724 | 21,582 | 108,083 | 240,727 | 385,268 | 542,725 | 715,032 |
| Accounts Receivable | 135,038 | 115,038 | 95,038 | 75,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 |
| Inventory | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 |
| Total Current Assets | 186,752 | 158,956 | 141,345 | 110,566 | 94,054 | 94,932 | 111,790 | 198,291 | 330,935 | 475,476 | 632,933 | 805,240 |
| **Current Liabilities** | | | | | | | | | | | | |
| Accounts Payable & Accruals | 280,866 | 280,866 | 280,866 | 270,866 | 240,866 | 185,866 | 125,866 | 105,866 | 105,866 | 105,866 | 105,866 | 105,866 |
| Bank Borrowings | - | - | - | - | - | - | - | - | - | - | - | - |
| Short Term Loans | - | - | - | - | - | - | - | - | - | - | - | - |
| Tax payable | 19,469 | 25,541 | 24,017 | 24,012 | 25,249 | 26,345 | 27,728 | 28,813 | 29,945 | 31,128 | 32,399 | 33,828 |
| Total Current Liabilities | 300,335 | 306,407 | 304,883 | 294,878 | 266,115 | 212,211 | 153,594 | 134,679 | 135,811 | 136,994 | 138,265 | 139,694 |
| Net Current Assets / (Liabilities) | - 113,583 | - 147,451 | - 163,538 | - 184,312 | - 172,060 | - 117,280 | - 41,804 | 63,612 | 195,123 | 338,482 | 494,667 | 665,546 |
| Long Term Loans | - | | 163,270 | 350,310 | 412,800 | 450,600 | 480,000 | 480,000 | 480,000 | 480,000 | 480,000 | 480,000 |
| Net Assets | 288,134 | 277,807 | 271,277 | 269,848 | 280,620 | 315,572 | 364,148 | 423,065 | 508,077 | 604,936 | 714,623 | 839,001 |

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**BALANCE SHEET 1996 - 2007**
**(All Data is in Millions of Manats)**

| | Estimated 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Capital & Reserves** | | | | | | | | | | | | |
| **Share Capital** | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| **Revaluation Reserve** | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 |
| **Replacement Cost Depreciation Reserve** | | 221,489 | 431,203 | 628,580 | 817,052 | 1,002,814 | 1,189,559 | 1,378,846 | 1,570,714 | 1,763,671 | 1,957,750 | 2,152,993 |
| **Reserves** | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 |
| **Grants** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Profit Retained - Year** | -44,452 | -231,816 | -216,244 | -198,806 | -177,700 | -150,811 | -138,168 | -130,371 | -106,856 | -96,098 | -84,393 | -70,864 |
| **Profit Retained - Previous** | 0 | -44,452 | -276,268 | -492,512 | -691,318 | -869,017 | -1,019,829 | -1,157,997 | -1,288,368 | -1,395,223 | -1,491,321 | -1,575,714 |
| **Total Capital & Reserves** | 288,134 | 277,807 | 271,277 | 269,848 | 280,620 | 315,572 | 364,148 | 423,065 | 508,077 | 604,936 | 714,623 | 839,001 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Current Assets / Current Liabilities** | 62.2% | 51.9% | 46.4% | 37.5% | 35.3% | 44.7% | 72.8% | 147.2% | 243.7% | 347.1% | 457.8% | 576.4% |
| **Quick Assets / Current Liabilities** | 50.5% | 40.4% | 34.8% | 25.6% | 22.1% | 28.2% | 49.9% | 121.1% | 217.8% | 321.4% | 432.3% | 551.3% |
| **Long Term Debt / Equity Ratio** | 0.0% | 0.0% | 60.2% | 129.8% | 147.1% | 142.8% | 131.8% | 113.5% | 94.5% | 79.3% | 67.2% | 57.2% |
| **Profit Before Tax / Net Fixed Assets** | -8.7% | -46.6% | -31.5% | -21.3% | -16.8% | -12.9% | -10.8% | -10.0% | -7.0% | -5.4% | -3.3% | -0.6% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**OPTIMISTIC SCENARIO**

| Summary of Expense Type | Actual 1996 | Projected 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salary | 13,467 | 28,292 | 29,072 | 29,889 | 26,440 | 24,366 | 22,463 | 22,611 | 22,815 | 23,043 | 22,987 | 21,987 |
| Social Insurance | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| Materials | 10,043 | 24,128 | 23,445 | 22,945 | 21,960 | 21,919 | 22,412 | 22,968 | 23,542 | 24,136 | 24,746 | 25,377 |
| Fuel | 10,185 | 20,088 | 20,085 | 19,496 | 18,991 | 18,516 | 19,300 | 20,151 | 21,034 | 21,948 | 22,892 | 23,870 |
| Power | 1,365 | 3,982 | 3,941 | 3,903 | 3,783 | 3,700 | 3,628 | 3,618 | 3,608 | 3,600 | 3,589 | 3,579 |
| Depreciation | 11,875 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 233,244 | 235,787 | 238,367 | 239,456 | 240,579 | 241,742 |
| Other | 30,446 | 41,926 | 41,213 | 40,563 | 39,620 | 39,238 | 39,254 | 39,497 | 39,751 | 40,020 | 40,285 | 40,565 |
| Total | 81,155 | 374,801 | 368,814 | 363,154 | 350,337 | 345,841 | 347,040 | 351,416 | 355,962 | 359,116 | 361,974 | 363,716 |
| Change from prior year | | 361.8% | -1.6% | -1.5% | -3.5% | -1.3% | 0.3% | 1.3% | 1.3% | 0.9% | 0.8% | 0.5% |
| **Summary by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 7,048 | 48,709 | 48,943 | 49,184 | 48,788 | 48,464 | 48,198 | 48,350 | 48,509 | 48,678 | 48,855 | 49,041 |
| Freight & Commercial | 2,685 | 8,517 | 8,666 | 8,840 | 8,200 | 7,639 | 7,170 | 7,205 | 7,245 | 7,283 | 7,322 | 7,364 |
| Locomotive | 30,087 | 148,781 | 140,160 | 131,662 | 121,206 | 117,658 | 119,522 | 122,181 | 124,931 | 127,767 | 130,518 | 132,124 |
| Wagons | 15,258 | 34,366 | 36,492 | 38,769 | 40,151 | 41,480 | 42,859 | 44,488 | 46,113 | 46,214 | 46,280 | 46,351 |
| Track | 18,129 | 115,721 | 115,929 | 116,141 | 114,832 | 114,393 | 113,982 | 114,029 | 114,140 | 114,252 | 114,237 | 114,221 |
| Civil | 514 | 1,225 | 1,186 | 1,150 | 994 | 898 | 811 | 808 | 805 | 802 | 780 | 760 |
| Signalling & Telecoms | 3,276 | 7,250 | 7,284 | 7,325 | 6,705 | 6,366 | 6,044 | 5,996 | 5,952 | 5,938 | 5,893 | 5,850 |
| Electrical Supply | 976 | 1,669 | 1,616 | 1,563 | 1,350 | 1,221 | 1,100 | 1,071 | 1,041 | 1,021 | 993 | 967 |
| Railway Sections | 3,182 | 8,563 | 8,539 | 8,520 | 8,110 | 7,722 | 7,353 | 7,288 | 7,227 | 7,161 | 7,096 | 7,037 |
| Total | 81,155 | 374,801 | 368,814 | 363,154 | 350,337 | 345,841 | 347,040 | 351,416 | 355,962 | 359,116 | 361,974 | 363,716 |
| Change from prior year | | 361.8% | -1.6% | -1.5% | -3.5% | -1.3% | 0.3% | 1.3% | 1.3% | 0.9% | 0.8% | 0.5% |
| **Salary by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 1,606 | 2,958 | 3,043 | 3,128 | 2,753 | 2,424 | 2,133 | 2,128 | 2,121 | 2,117 | 2,112 | 2,107 |
| Freight & Commercial | 1,431 | 4,042 | 4,156 | 4,276 | 3,763 | 3,312 | 2,914 | 2,905 | 2,899 | 2,891 | 2,884 | 2,879 |
| Locomotive | 3,955 | 7,718 | 7,926 | 8,153 | 7,173 | 6,708 | 6,271 | 6,386 | 6,505 | 6,625 | 6,612 | 5,645 |
| Wagons | 1,174 | 2,552 | 2,624 | 2,699 | 2,376 | 2,222 | 2,076 | 2,094 | 2,109 | 2,128 | 2,121 | 2,117 |
| Track | 2,692 | 5,592 | 5,752 | 5,915 | 5,205 | 4,868 | 4,551 | 4,588 | 4,673 | 4,759 | 4,748 | 4,735 |
| Civil | 76 | 176 | 181 | 186 | 164 | 153 | 143 | 147 | 152 | 156 | 156 | 155 |
| Signalling & Telecoms | 1,254 | 2,626 | 2,700 | 2,779 | 2,445 | 2,285 | 2,136 | 2,131 | 2,127 | 2,142 | 2,138 | 2,134 |
| Electrical Supply | 98 | 224 | 231 | 237 | 208 | 195 | 182 | 182 | 181 | 183 | 182 | 182 |
| Railway Sections | 1,181 | 2,404 | 2,459 | 2,516 | 2,352 | 2,199 | 2,056 | 2,051 | 2,047 | 2,041 | 2,035 | 2,032 |
| Total | 13,467 | 28,292 | 29,072 | 29,889 | 26,440 | 24,366 | 22,463 | 22,611 | 22,815 | 23,043 | 22,987 | 21,987 |
| Change from prior year | | 110.1% | 2.8% | 2.8% | -11.5% | -7.8% | -7.8% | 0.7% | 0.9% | 1.0% | -0.2% | -4.4% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**OPTIMISTIC SCENARIO**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Employment by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 2,193 | 2,144 | 2,005 | 1,874 | 1,499 | 1,200 | 960 | 912 | 866 | 823 | 782 | 743 |
| Freight & Commercial | 2,803 | 2,609 | 2,439 | 2,281 | 1,825 | 1,460 | 1,168 | 1,109 | 1,054 | 1,001 | 951 | 904 |
| Locomotive | 3,114 | 3,149 | 2,944 | 2,753 | 2,202 | 1,872 | 1,591 | 1,543 | 1,497 | 1,452 | 1,380 | 1,049 |
| Wagons | 1,748 | 1,764 | 1,649 | 1,542 | 1,234 | 1,049 | 891 | 856 | 821 | 789 | 749 | 712 |
| Track | 4,630 | 4,743 | 4,435 | 4,146 | 3,317 | 2,820 | 2,397 | 2,301 | 2,232 | 2,165 | 2,057 | 1,954 |
| Civil | 935 | 822 | 769 | 719 | 575 | 489 | 415 | 407 | 399 | 391 | 371 | 353 |
| Signalling & Telecoms | 1,654 | 1,657 | 1,549 | 1,449 | 1,159 | 985 | 837 | 795 | 756 | 725 | 689 | 655 |
| Electrical Supply | 443 | 452 | 423 | 395 | 316 | 269 | 228 | 217 | 206 | 198 | 188 | 179 |
| Railway Sections | 1,710 | 1,695 | 1,576 | 1,466 | 1,246 | 1,059 | 900 | 855 | 813 | 772 | 733 | 697 |
| Total | 19,230 | 19,035 | 17,789 | 16,625 | 13,373 | 11,203 | 9,387 | 8,995 | 8,644 | 8,316 | 7,900 | 7,246 |
| Change from prior year | | -1.0% | -6.5% | -6.5% | -19.6% | -16.2% | -16.2% | -4.2% | -3.9% | -3.8% | -5.0% | -8.3% |
| **Social Insurance** | | | | | | | | | | | | |
| Passenger Service | 450 | 887 | 913 | 939 | 826 | 727 | 640 | 638 | 636 | 635 | 634 | 632 |
| Freight & Commercial | 401 | 1,213 | 1,247 | 1,283 | 1,129 | 993 | 874 | 872 | 870 | 867 | 865 | 864 |
| Locomotive | 1,107 | 2,315 | 2,378 | 2,446 | 2,152 | 2,012 | 1,881 | 1,916 | 1,952 | 1,988 | 1,984 | 1,694 |
| Wagons | 329 | 715 | 787 | 810 | 713 | 667 | 623 | 628 | 633 | 638 | 636 | 635 |
| Track | 757 | 1,678 | 1,726 | 1,774 | 1,562 | 1,460 | 1,365 | 1,376 | 1,402 | 1,428 | 1,424 | 1,421 |
| Civil | 21 | 53 | 54 | 56 | 49 | 46 | 43 | 44 | 46 | 47 | 47 | 47 |
| Signalling & Telecoms | 351 | 788 | 810 | 834 | 733 | 686 | 641 | 639 | 638 | 643 | 641 | 640 |
| Electrical Supply | 27 | 67 | 69 | 71 | 63 | 59 | 55 | 55 | 54 | 55 | 55 | 55 |
| Railway Sections | 331 | 721 | 738 | 755 | 706 | 660 | 617 | 615 | 614 | 612 | 611 | 610 |
| Total | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| Change from prior year | | 123.6% | 3.4% | 2.8% | -11.5% | -7.8% | -7.8% | 0.7% | 0.9% | 1.0% | -0.2% | -4.4% |
| **Materials by Operation Unit** | | | | | | | | | | | | |
| Passenger Service | 978 | 1,190 | 1,250 | 1,312 | 1,378 | 1,446 | 1,519 | 1,595 | 1,674 | 1,758 | 1,846 | 1,938 |
| Freight & Commercial | 81 | 346 | 346 | 348 | 351 | 354 | 359 | 364 | 369 | 374 | 379 | 384 |
| Locomotive | 7,043 | 17,000 | 16,290 | 15,757 | 15,184 | 15,136 | 15,609 | 16,094 | 16,592 | 17,105 | 17,631 | 18,173 |
| Wagons | 123 | 460 | 465 | 469 | 474 | 479 | 487 | 496 | 504 | 513 | 522 | 531 |
| Track | 1,384 | 3,862 | 3,862 | 3,862 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 |
| Civil | 20 | 76 | 73 | 69 | 60 | 53 | 48 | 47 | 46 | 46 | 44 | 43 |
| Signalling & Telecoms | 71 | 220 | 216 | 213 | 202 | 195 | 187 | 185 | 183 | 181 | 179 | 176 |
| Electrical Supply | 61 | 472 | 451 | 430 | 370 | 331 | 296 | 286 | 276 | 268 | 259 | 250 |
| Railway Sections | 282 | 502 | 493 | 485 | 466 | 449 | 432 | 427 | 421 | 416 | 411 | 406 |
| Total | 10,043 | 24,128 | 23,445 | 22,945 | 21,960 | 21,919 | 22,412 | 22,968 | 23,542 | 24,136 | 24,746 | 25,377 |
| Change from prior year | | 140.2% | -2.8% | -2.1% | -4.3% | -0.2% | 2.2% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |

**TDY Railroad Operating Expenses Summary (In Millions of Manats)**
**OPTIMISTIC SCENARIO**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Fuel by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 139 | 334 | 337 | 340 | 314 | 290 | 268 | 273 | 278 | 283 | 289 | 294 |
| Freight & Commercial | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Locomotive | 9,743 | 18,900 | 18,904 | 18,322 | 17,871 | 17,439 | 18,262 | 19,113 | 19,995 | 20,908 | 21,851 | 22,829 |
| Wagons | 103 | 242 | 233 | 223 | 197 | 179 | 163 | 159 | 155 | 151 | 147 | 143 |
| Track | 176 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 |
| Civil | - | - | - | - | - | - | - | - | - | - | - | - |
| Signalling & Telecoms | 15 | 26 | 26 | 25 | 24 | 23 | 22 | 22 | 22 | 21 | 21 | 21 |
| Electrical Supply | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Railway Sections | 6 | 14 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 |
| Total | 10,185 | 20,088 | 20,085 | 19,496 | 18,991 | 18,516 | 19,300 | 20,151 | 21,034 | 21,948 | 22,892 | 23,870 |
| Change from prior year | | 97.2% | 0.0% | -2.9% | -2.6% | -2.5% | 4.2% | 4.4% | 4.4% | 4.3% | 4.3% | 4.3% |
| **Power Supply by Operation Unit** | | | | | | | | | | | | |
| Passenger Service | 45 | 152 | 153 | 155 | 143 | 132 | 122 | 124 | 127 | 129 | 131 | 134 |
| Freight & Commercial | 232 | 1,312 | 1,312 | 1,315 | 1,318 | 1,322 | 1,328 | 1,334 | 1,340 | 1,346 | 1,353 | 1,359 |
| Locomotive | 445 | 592 | 586 | 581 | 574 | 572 | 573 | 574 | 575 | 576 | 577 | 578 |
| Wagons | 109 | 432 | 415 | 399 | 351 | 320 | 291 | 284 | 277 | 270 | 262 | 254 |
| Track | 103 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 |
| Civil | 10 | 14 | 13 | 13 | 11 | 10 | 9 | 9 | 9 | 8 | 8 | 8 |
| Signalling & Telecoms | 355 | 1,042 | 1,025 | 1,008 | 958 | 922 | 887 | 876 | 866 | 857 | 846 | 836 |
| Electrical Supply | - | - | - | - | - | - | - | - | - | - | - | - |
| Railway Sectios | 66 | 144 | 141 | 139 | 134 | 129 | 124 | 122 | 121 | 119 | 118 | 116 |
| Total | 1,365 | 3,982 | 3,941 | 3,903 | 3,783 | 3,700 | 3,628 | 3,618 | 3,608 | 3,600 | 3,589 | 3,579 |
| Change from prior year | | 191.7% | -1.0% | -1.0% | -3.1% | -2.2% | -2.0% | -0.3% | -0.3% | -0.2% | -0.3% | -0.3% |
| **Depreciation by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 743 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 |
| Freight & Commercial | 82 | 164 | 164 | 164 | 164 | 165 | 165 | 165 | 166 | 166 | 167 | 167 |
| Locomotive | 2,083 | 89,936 | 82,404 | 75,340 | 67,851 | 65,583 | 66,581 | 67,614 | 68,684 | 69,790 | 70,935 | 72,121 |
| Wagons | 2,560 | 25,937 | 27,900 | 30,060 | 31,890 | 33,423 | 34,955 | 36,487 | 38,020 | 38,020 | 38,020 | 38,020 |
| Track | 5,499 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 |
| Civil | 77 | 154 | 147 | 140 | 121 | 108 | 97 | 95 | 94 | 93 | 89 | 86 |
| Signalling & Telecoms | 633 | 1,272 | 1,251 | 1,231 | 1,169 | 1,126 | 1,083 | 1,070 | 1,057 | 1,046 | 1,033 | 1,020 |
| Electrical Supply | 144 | 290 | 277 | 264 | 227 | 204 | 182 | 176 | 169 | 165 | 159 | 154 |
| Railway Sections | 54 | 108 | 106 | 104 | 100 | 97 | 93 | 92 | 91 | 90 | 88 | 87 |
| Total | 11,875 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 233,244 | 235,787 | 238,367 | 239,456 | 240,579 | 241,742 |
| Change from prior year | | 1988.0% | -2.3% | -2.0% | -2.4% | -0.4% | 1.1% | 1.1% | 1.1% | 0.5% | 0.5% | 0.5% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**OPTIMISTIC SCENARIO**

| | Actual | Projected | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Repair Fund & Other Expenses by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 3,087 | 1,188 | 1,247 | 1,310 | 1,375 | 1,444 | 1,516 | 1,592 | 1,672 | 1,755 | 1,843 | 1,935 |
| Freight & Commercial | 456 | 1,438 | 1,438 | 1,453 | 1,472 | 1,492 | 1,527 | 1,563 | 1,599 | 1,635 | 1,672 | 1,710 |
| Locomotive | 5,711 | 12,320 | 11,671 | 11,064 | 10,401 | 10,208 | 10,344 | 10,484 | 10,628 | 10,776 | 10,928 | 11,084 |
| Wagons | 10,860 | 4,028 | 4,068 | 4,109 | 4,150 | 4,192 | 4,265 | 4,340 | 4,415 | 4,493 | 4,571 | 4,651 |
| Track | 7,518 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 |
| Civil | 310 | 752 | 718 | 685 | 589 | 528 | 472 | 465 | 459 | 452 | 436 | 421 |
| Signalling & Telecoms | 597 | 1,276 | 1,255 | 1,235 | 1,173 | 1,129 | 1,087 | 1,073 | 1,060 | 1,049 | 1,036 | 1,023 |
| Electrical Supply | 645 | 616 | 588 | 561 | 483 | 432 | 386 | 373 | 360 | 350 | 338 | 326 |
| Railway Sections | 1,262 | 4,670 | 4,588 | 4,508 | 4,339 | 4,176 | 4,019 | 3,969 | 3,920 | 3,871 | 3,822 | 3,775 |
| Total | 30,446 | 41,926 | 41,213 | 40,563 | 39,620 | 39,238 | 39,254 | 39,497 | 39,751 | 40,020 | 40,285 | 40,565 |
| Change from prior year | | 37.7% | -1.7% | -1.6% | -2.3% | -1.0% | 0.0% | 0.6% | 0.6% | 0.7% | 0.7% | 0.7% |

TURKMENISTAN RAILWAYS
OPTIMISTIC SCENARIO
FREIGHT TRAFFIC & REVENUE FORECASTS

| | Actual | | | | | Projected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tonnage by Commodity (Thousands Tonnes)** | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Petroleum Products | 4293 | 4,379 | 4,466 | 4,556 | 4,647 | 4,740 | 4,906 | 5,077 | 5,255 | 5,439 | 5,629 | 5,826 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Construction Materials | 4424 | 4,512 | 4,603 | 4,695 | 4,789 | 4,884 | 5,055 | 5,232 | 5,415 | 5,605 | 5,801 | 6,004 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Fertilisers | 813 | 829 | 846 | 863 | 880 | 898 | 929 | 962 | 995 | 1,030 | 1,066 | 1,103 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Cement | 622 | 634 | 647 | 660 | 673 | 687 | 711 | 736 | 761 | 788 | 816 | 844 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Cotton | 352 | 359 | 366 | 374 | 381 | 389 | 402 | 416 | 431 | 446 | 462 | 478 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Other | 5399 | 5,507 | 5,617 | 5,729 | 5,844 | 5,961 | 6,170 | 6,385 | 6,609 | 6,840 | 7,080 | 7,328 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Total | 15903 | 16,221 | 16,545 | 16,876 | 17,214 | 17,558 | 18,173 | 18,809 | 19,467 | 20,148 | 20,854 | 21,584 |

| | Actual | | | | | Projected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tonne Kilometres by Commodity (Millions Tonne Kilometres)** | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Petroleum Products | 2,578 | 2,630 | 2,683 | 2,736 | 2,791 | 2,847 | 2,946 | 3,049 | 3,156 | 3,267 | 3,381 | 3,499 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Construction Materials | 1,496 | 1,526 | 1,556 | 1,587 | 1,619 | 1,651 | 1,709 | 1,769 | 1,831 | 1,895 | 1,961 | 2,030 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Fertilisers | 119 | 121 | 124 | 126 | 129 | 131 | 136 | 141 | 145 | 151 | 156 | 161 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Cement | 216 | 220 | 225 | 229 | 234 | 238 | 247 | 255 | 264 | 274 | 283 | 293 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Cotton | 162 | 165 | 169 | 172 | 176 | 179 | 185 | 192 | 199 | 205 | 213 | 220 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Other | 2,432 | 2,480 | 2,530 | 2,581 | 2,632 | 2,685 | 2,779 | 2,876 | 2,977 | 3,081 | 3,189 | 3,300 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% | 3.5% |
| Total | 7,003 | 7,143 | 7,286 | 7,431 | 7,580 | 7,732 | 8,002 | 8,282 | 8,572 | 8,872 | 9,183 | 9,504 |
| **Average Length of Haul** | | | | | | | | | | | | |
| Petroleum Products | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 |
| Construction Materials | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 |
| Fertilisers | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 |
| Cement | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 |
| Cotton | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 |
| Other | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 |
| Total | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 |

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**FREIGHT TRAFFIC & REVENUE FORECASTS**

| | Actual | Projected | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenue per tonne-km** | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| % real change from prior year | | 70.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Inflation | | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| Nominal % change from prior year | | 70.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Revenue per tonne-km | 19.7 | 33.4659 | 33.8005 | 34.1386 | 34.4799 | 34.8247 | 35.1730 | 35.5247 | 35.8800 | 36.2388 | 36.6011 | 36.9672 |
| **Revenue** | | | | | | | | | | | | |
| % collected in cash | 40.0% | 40.0% | 45.0% | 55.0% | 60.0% | 70.0% | 75.0% | 75.0% | 80.0% | 80.0% | 80.0% | 80.0% |
| % collected in barter | 40.0% | 40.0% | 35.0% | 30.0% | 25.0% | 20.0% | 15.0% | 15.0% | 15.0% | 15.0% | 15.0% | 15.0% |
| Barter conversion cost | | 20.0% | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* |
| % bad debt | 20.0% | 20.0% | 20.0% | 15.0% | 15.0% | 10.0% | 10.0% | 10.0% | 5.0% | 5.0% | 5.0% | 5.0% |
| Cash (000,000) | 55,142 | 95,616 | 110,816 | 139,532 | 156,814 | 188,475 | 211,095 | 220,668 | 246,054 | 257,212 | 268,877 | 281,070 |
| Barter (000,000) | 55,142 | 95,616 | 86,190 | 76,108 | 65,339 | 53,850 | 42,219 | 44,134 | 46,135 | 48,227 | 50,414 | 52,701 |
| Barter conversion cost (000,000) | | 19,123 | 17,238 | 15,222 | 13,068 | 10,770 | 8,444 | 8,827 | 9,227 | 9,645 | 10,083 | 10,540 |
| Bad debt (000,000) | 27,571 | 47,808 | 49,252 | 38,054 | 39,203 | 26,925 | 28,146 | 29,422 | 15,378 | 16,076 | 16,805 | 17,567 |
| Total revenue (000,000) | 137,854 | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 281,460 | 294,224 | 307,567 | 321,515 | 336,096 | 351,338 |
| % increase | | | | | | | | | | | | |
| Total revenue collected (000,000) | 110,283 | 191,231 | 197,006 | 215,641 | 222,153 | 242,324 | 253,314 | 264,802 | 292,189 | 305,439 | 319,291 | 333,771 |

**TURKMENISTAN RAILWAYS**
**OPTIMISTIC SCENARIO**
**PASSENGER TRAFFIC & REVENUE FORECASTS**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Passenger-km** | | | | | | | | | | | | |
| Change from prior year | *12.2%* | *-54.7%* | *-14.8%* | *2.2%* | *8.7%* | *8.7%* | *14.4%* | *12.9%* | *11.9%* | *11.0%* | *10.2%* | *9.6%* |
| Pass-km (000,000) | 2,104 | 954 | 813 | 831 | 903 | 982 | 1,123 | 1,268 | 1,419 | 1,575 | 1,736 | 1,903 |
| **Revenue per passenger-km** | | | | | | | | | | | | |
| % real change from prior year | 930.6% | 688.9% | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* |
| Inflation | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| Nominal % change from prior year | 930.6% | 688.9% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Revenue per passenger-km | 3.5873 | 28.2989 | 28.5819 | 28.8677 | 29.1564 | 29.4480 | 29.7424 | 30.0399 | 30.3403 | 30.6437 | 30.9501 | 31.2596 |
| **Revenue** | 7,547 | 26,995 | 23,235 | 23,987 | 26,325 | 28,915 | 33,395 | 38,083 | 43,041 | 48,249 | 53,717 | 59,479 |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**OPERATING STATISTICS**

| | Actual 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Key Assumptions** | | | | | | | | | | | | |
| Inflation rate [relates current to previous year's expenses] | | | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **Key Operating Statistics** | | | | | | | | | | | | |
| Freight tonnes (000) | 15,903 | 16,221 | 16,545 | 16,876 | 17,214 | 17,558 | 17,909 | 18,268 | 18,633 | 19,006 | 19,386 | 19,773 |
| Freight tkm (000,000) | 7,003 | 7,143 | 7,286 | 7,431 | 7,580 | 7,732 | 7,886 | 8,044 | 8,205 | 8,369 | 8,536 | 8,707 |
| Ave. length of haul | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 |
| Passenger km (000,000) | 2,103 | 954 | 813 | 831 | 761 | 837 | 914 | 993 | 1,074 | 1,156 | 1,240 | 1,325 |
| Locomotive km (000) | 6,998 | 7,092 | 7,187 | 7,284 | 7,383 | 7,484 | 7,587 | 7,693 | 7,800 | 7,909 | 8,021 | 8,135 |
| Train km (000) | 6,998 | 7,092 | 7,187 | 7,284 | 7,383 | 7,484 | 7,587 | 7,693 | 7,800 | 7,909 | 8,021 | 8,135 |
| Wagon km (000,000) | 226 | 230 | 235 | 239 | 244 | 249 | 254 | 259 | 264 | 270 | 275 | 280 |
| Employment - core activity | 19,230 | 19,035 | 17,789 | 16,625 | 13,373 | 11,203 | 9,387 | 8,995 | 8,644 | 8,316 | 7,900 | 7,246 |
| Percentage change | | -1.0% | -6.5% | -6.5% | -19.6% | -16.2% | -16.2% | -4.2% | -3.9% | -3.8% | -5.0% | -8.3% |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**PROFIT AND LOSS ACCOUNT 1996 - 2001**
**(All Data Is In Millions of Manats)**

| | | Actual 1996 Millions | Forecast 1997 Millions | Forecast, 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operating Revenue | | | | | | | | | | | | | |
| Freight Business | | 137,854 | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 277,381 | 285,758 | 294,387 | 303,278 | 312,437 | 321,873 |
| Passenger Business | | 7,544 | 26,995 | 23,238 | 23,990 | 22,190 | 24,649 | 27,186 | 29,830 | 32,584 | 35,423 | 38,376 | 41,417 |
| Auxilliary Activities Income | | 8,720 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 |
| Other Income | | 1,240 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 |
| Total Operating Revenue | | 155,358 | 278,592 | 282,054 | 290,243 | 296,104 | 306,457 | 317,125 | 328,146 | 339,530 | 351,259 | 363,371 | 375,847 |
| Operating Subsidy | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Operating Revenue | | 155,358 | 278,592 | 282,054 | 290,243 | 296,104 | 306,457 | 317,125 | 328,146 | 339,530 | 351,259 | 363,371 | 375,847 |
| Operating Expenses | | | | | | | | | | | | | |
| Salary - per accounts | | 13,467.0 | 28,292.0 | 29,071.9 | 29,888.7 | 26,439.6 | 24,366.3 | 22,463.0 | 22,611.3 | 22,815.4 | 23,043.0 | 22,987.2 | 21,986.8 |
| Social Insurance | | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| - Consumption Fund Payments | | 5,940 | 15,000 | 14,018 | 13,101 | 10,538 | 8,828 | 7,397 | 7,088 | 6,812 | 6,553 | 6,225 | 5,710 |
| - Development Fund Payments | | 786 | 7,000 | 6,542 | 6,114 | 4,918 | 4,120 | 3,452 | 3,308 | 3,179 | 3,058 | 2,905 | 2,665 |
| Materials | | 10,043 | 24,128 | 23,445 | 22,945 | 21,823 | 21,783 | 22,066 | 22,404 | 22,750 | 23,107 | 23,470 | 23,842 |
| Fuel | | 10,185 | 20,088 | 20,086 | 19,497 | 18,692 | 18,226 | 18,650 | 19,124 | 19,609 | 20,103 | 20,606 | 21,118 |
| Electrical power supply | | 1,365 | 3,982 | 3,941 | 3,903 | 3,781 | 3,698 | 3,622 | 3,609 | 3,596 | 3,586 | 3,572 | 3,558 |
| Repair Fund & Other operating expenses | | 30,446 | 41,926 | 41,213 | 40,563 | 39,592 | 39,210 | 39,121 | 39,255 | 39,397 | 39,549 | 39,693 | 39,848 |
| Bad Debt | | 0 | 47,808 | 49,252 | 38,054 | 39,203 | 26,925 | 27,738 | 28,576 | 14,719 | 15,164 | 15,622 | 16,094 |
| Barter Conversion | | 0 | 19,123 | 17,238 | 15,222 | 13,068 | 10,770 | 8,321 | 8,573 | 8,832 | 9,098 | 9,373 | 9,656 |
| Social Needs Expenditures | | 1,351 | 13,000 | 12,149 | 11,354 | 9,133 | 7,651 | 6,411 | 6,143 | 5,903 | 5,679 | 5,395 | 4,949 |
| Total Operating Expenses | | 77,357 | 228,783 | 225,676 | 209,607 | 195,120 | 172,888 | 165,981 | 167,475 | 154,457 | 155,853 | 156,745 | 156,023 |
| Operating Profit Before Depreciation | | 78,001 | 49,808 | 56,377 | 80,635 | 100,984 | 133,569 | 151,144 | 160,671 | 185,073 | 195,405 | 206,627 | 219,825 |
| Depreciation | | 11,875.0 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 232,816 | 234,908 | 237,012 | 237,599 | 238,193 | 238,801 |
| Operating Profit | | 66,126 | -198,140 | -185,960 | -156,756 | -130,627 | -97,223 | -81,672 | -74,237 | -51,939 | -42,194 | -31,567 | -18,977 |
| Interest - Loans | | - | - | 2,700 | 14,485 | 18,234 | 20,502 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 |
| Interest - Bank Borrowings | | - | - | - | - | - | 92 | | | | | | |
| Extraordiary Items | | 101,188 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit / (Loss) before tax | | -35,062 | -198,140 | -188,660 | -171,241 | -148,861 | -117,817 | -103,938 | -96,503 | -74,205 | -64,460 | -53,833 | -41,243 |
| Tax | | 9,390 | 33,676 | 27,583 | 27,563 | 31,481 | 35,829 | 39,896 | 42,672 | 45,511 | 48,422 | 51,558 | 55,173 |
| Profit Retained | | -44,452 | -231,816 | -216,242 | -198,804 | -180,342 | -153,646 | -143,834 | -139,174 | -119,715 | -112,882 | -105,391 | -96,416 |
| | | | | | | | | | | | | | |
| Operating Profit before Depreciation % | | 50.2% | 17.9% | 20.0% | 27.8% | 34.1% | 43.6% | 47.7% | 49.0% | 54.5% | 55.6% | 56.9% | 58.5% |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**CASH FLOW STATEMENT 1997 - 2007**
**(All Data is in Millions of Manats)**

| | | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RECEIPTS | | | | | | | | | | | | |
| Freight Revenue | | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 277,381 | 285,758 | 294,387 | 303,278 | 312,437 | 321,873 |
| Passenger Revenue | | 26,995 | 23,238 | 23,990 | 22,190 | 24,649 | 27,186 | 29,830 | 32,584 | 35,423 | 38,376 | 41,417 |
| Auxiliary Activity Income | | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 | 11,484 |
| Other Revenue | | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 | 1,074 |
| Operating Subsidy | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decrease in Accounts Receivable | | 20,000 | 20,000 | 20,000 | 20,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capital Grant - Repayment of Loans | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Grants | | | | | | | | | | | | |
| Loans received | | 0 | 163,270 | 187,040 | 62,490 | 37,800 | 29,400 | 0 | 0 | 0 | 0 | 0 |
| Total | 0.0 | 298,592 | 465,324 | 497,283 | 378,594 | 344,257 | 346,525 | 328,146 | 339,530 | 351,259 | 363,371 | 375,847 |
| PAYMENTS | | | | | | | | | | | | |
| Operating Expenses | | 228,783 | 225,676 | 209,607 | 195,120 | 172,888 | 165,981 | 167,475 | 154,457 | 155,853 | 156,745 | 156,023 |
| Increase in Inventory | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decrease in Accounts Payable | | 0 | 0 | 10,000 | 30,000 | 55,000 | 60,000 | 20,000 | 0 | 0 | 0 | 0 |
| Capital Investment | | 50,000 | 205,450 | 246,400 | 104,150 | 63,000 | 49,000 | 0 | 0 | 0 | 0 | 0 |
| Interest - Loans | | 0 | 2,700 | 14,485 | 18,234 | 20,502 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 | 22,266 |
| Loan Repayments | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Interest - Bank Borrowings | | 0 | 0 | 0 | 0 | 92 | 0 | 0 | 0 | 0 | 0 | 0 |
| Profit Tax Paid | | 27,605 | 29,106 | 27,568 | 30,501 | 34,742 | 38,879 | 41,978 | 44,801 | 47,694 | 50,774 | 54,270 |
| Total | 0.0 | 306,388 | 462,933 | 508,060 | 378,005 | 346,224 | 336,127 | 251,719 | 221,524 | 225,814 | 229,785 | 232,558 |
| Cash Increase / (Decrease) | 0 | -7,796 | 2,391 | -10,778 | 589 | -1,967 | 10,398 | 76,427 | 118,006 | 125,445 | 133,587 | 143,289 |
| Balance Previous Year | | 16,544 | 8,748 | 11,139 | 361 | 950 | -1,017 | 9,381 | 85,808 | 203,814 | 329,259 | 462,846 |
| Cash at Year End | 0 | 8,748 | 11,139 | 361 | 950 | -1,017 | 9,381 | 85,808 | 203,814 | 329,259 | 462,846 | 606,135 |
| Annual Interest Rate | | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% | 10% |
| Debt Service Coverage (Times) (Available Cash/Interest Payments) | | | 0.9 | -0.7 | 0.0 | -0.1 | 0.5 | 3.4 | 5.3 | 5.6 | 6.0 | 6.4 |

TURKMENISTAN RAILWAYS
PESSIMISTIC SCENARIO
BALANCE SHEET 1996 - 2007
(All Data is in Millions of Manats)

| | | Estimated 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fixed Assets** | | | | | | | | | | | | | |
| Gross Fixed Assets & Capital WIP | | 831,976 | 881,976 | 1,087,426 | 1,333,826 | 1,437,976 | 1,500,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 | 1,549,976 |
| Less: Depreciation | | 430,260 | 456,719 | 489,342 | 529,357 | 572,496 | 617,525 | 664,025 | 710,524 | 757,023 | 803,523 | 850,022 | 896,521 |
| Net Fixed Assets | | 401,716 | 425,257 | 598,084 | 804,469 | 865,480 | 883,451 | 885,951 | 839,452 | 792,953 | 746,453 | 699,954 | 653,455 |
| Financial Long Term Assets | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Total Fixed Assets | | 401,717 | 425,258 | 598,085 | 804,470 | 865,481 | 883,452 | 885,952 | 839,453 | 792,954 | 746,454 | 699,955 | 653,456 |
| **Current Assets** | | | | | | | | | | | | | |
| Cash | | 16,544 | 8,748 | 11,139 | 361 | 950 | - | 9,381 | 85,808 | 203,814 | 329,259 | 462,846 | 606,135 |
| Accounts Receivable | | 135,038 | 115,038 | 95,038 | 75,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 | 55,038 |
| Inventory | | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 | 35,170 |
| Total Current Assets | | 186,752 | 158,956 | 141,347 | 110,569 | 91,158 | 90,208 | 99,589 | 176,016 | 294,022 | 419,467 | 553,054 | 696,343 |
| **Current Liabilities** | | | | | | | | | | | | | |
| Accounts Payable & Accruals | | 280,866 | 280,866 | 280,866 | 270,866 | 240,866 | 185,866 | 125,866 | 105,866 | 105,866 | 105,866 | 105,866 | 105,866 |
| Bank Borrowings | | - | - | - | - | - | 1,017 | - | - | - | - | - | - |
| Short Term Loans | | - | - | - | - | - | - | - | - | - | - | - | - |
| Tax payable | | 19,469 | 25,541 | 24,017 | 24,012 | 24,992 | 26,079 | 27,096 | 27,789 | 28,499 | 29,227 | 30,011 | 30,915 |
| Total Current Liabilities | | 300,335 | 306,407 | 304,883 | 294,878 | 265,858 | 212,962 | 152,962 | 133,655 | 134,365 | 135,093 | 135,877 | 136,781 |
| Net Current Assets / (Liabilities) | | - 113,583 | - 147,451 | - 163,536 | - 184,309 | - 174,700 | - 122,754 | - 53,373 | 42,361 | 159,657 | 284,374 | 417,177 | 559,562 |
| Long Term Loans | | - | | 163,270 | 350,310 | 412,800 | 450,600 | 480,000 | 480,000 | 480,000 | 480,000 | 480,000 | 480,000 |
| Net Assets | | 288,134 | 277,807 | 271,279 | 269,851 | 277,981 | 310,097 | 352,580 | 401,814 | 472,611 | 550,829 | 637,132 | 733,018 |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**BALANCE SHEET 1996 - 2007**
**(All Data is in Millions of Manats)**

| | | Estimated 1996 Millions | Forecast 1997 Millions | Forecast 1998 Millions | Forecast 1999 Millions | Forecast 2000 Millions | Forecast 2001 Millions | Forecast 2002 Millions | Forecast 2003 Millions | Forecast 2004 Millions | Forecast 2005 Millions | Forecast 2006 Millions | Forecast 2007 Millions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Capital & Reserves | | | | | | | | | | | | | |
| Share Capital | | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 | 36.0 |
| Revaluation Reserve | | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 | 329,168 |
| Replacement Cost Depreciation Reserve | | | 221,489 | 431,203 | 628,580 | 817,052 | 1,002,814 | 1,189,130 | 1,377,539 | 1,568,051 | 1,759,151 | 1,950,845 | 2,143,147 |
| Reserves | | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 | 3,382 |
| Grants | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Profit Retained - Year | | -44,452 | -231,816 | -216,242 | -198,804 | -180,342 | -153,646 | -143,834 | -139,174 | -119,715 | -112,882 | -105,391 | -96,416 |
| Profit Retained - Previous | | 0 | -44,452 | -276,268 | -492,511 | -691,315 | -871,656 | -1,025,303 | -1,169,137 | -1,308,311 | -1,428,026 | -1,540,908 | -1,646,299 |
| Total Capital & Reserves | | 288,134 | 277,807 | 271,279 | 269,851 | 277,981 | 310,097 | 352,580 | 401,814 | 472,611 | 550,829 | 637,132 | 733,018 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Current Assets / Current Liabilities | | 62.2% | 51.9% | 46.4% | 37.5% | 34.3% | 42.4% | 65.1% | 131.7% | 218.8% | 310.5% | 407.0% | 509.1% |
| Quick Assets / Current Liabilities | | 50.5% | 40.4% | 34.8% | 25.6% | 21.1% | 25.8% | 42.1% | 105.4% | 192.6% | 284.5% | 381.1% | 483.4% |
| Long Term Debt / Equity Ratio | | 0.0% | 0.0% | 60.2% | 129.8% | 148.5% | 145.3% | 136.1% | 119.5% | 101.6% | 87.1% | 75.3% | 65.5% |
| Profit Before Tax / Net Fixed Assets | | -8.7% | -46.6% | -31.5% | -21.3% | -17.2% | -13.3% | -11.7% | -11.5% | -9.4% | -8.6% | -7.7% | -6.3% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**PESSIMISTIC SCENARIO**

| Summary by Expense Type | Actual 1996 | Projected 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salary | 13,467 | 28,292 | 29,072 | 29,889 | 26,440 | 24,366 | 22,463 | 22,611 | 22,815 | 23,043 | 22,987 | 21,987 |
| Social Insurance | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| Materials | 10,043 | 24,128 | 23,445 | 22,945 | 21,823 | 21,783 | 22,066 | 22,404 | 22,750 | 23,107 | 23,470 | 23,842 |
| Fuel | 10,185 | 20,088 | 20,086 | 19,497 | 18,692 | 18,226 | 18,650 | 19,124 | 19,609 | 20,103 | 20,606 | 21,118 |
| Power | 1,365 | 3,982 | 3,941 | 3,903 | 3,781 | 3,698 | 3,622 | 3,609 | 3,596 | 3,586 | 3,572 | 3,558 |
| Depreciation | 11,875 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 232,816 | 234,908 | 237,012 | 237,599 | 238,193 | 238,801 |
| Other | 30,446 | 41,926 | 41,213 | 40,563 | 39,592 | 39,210 | 39,121 | 39,255 | 39,397 | 39,549 | 39,693 | 39,848 |
| **Total** | 81,155 | 374,801 | 368,815 | 363,154 | 349,870 | 345,385 | 345,477 | 348,695 | 352,024 | 353,899 | 355,418 | 355,751 |
| Change from prior year | | 361.8% | -1.6% | -1.5% | -3.7% | -1.3% | 0.0% | 0.9% | 1.0% | 0.5% | 0.4% | 0.1% |
| **Summary by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 7,048 | 48,709 | 48,943 | 49,184 | 48,788 | 48,464 | 48,198 | 48,350 | 48,509 | 48,678 | 48,855 | 49,041 |
| Freight & Commercial | 2,685 | 8,517 | 8,666 | 8,840 | 8,183 | 7,623 | 7,133 | 7,148 | 7,167 | 7,184 | 7,202 | 7,222 |
| Locomotive | 30,087 | 148,781 | 140,160 | 131,662 | 120,756 | 117,219 | 118,031 | 119,588 | 121,179 | 122,795 | 124,267 | 124,526 |
| Wagons | 15,258 | 34,366 | 36,492 | 38,769 | 40,151 | 41,480 | 42,824 | 44,417 | 46,005 | 46,068 | 46,095 | 46,126 |
| Track | 18,129 | 115,721 | 115,929 | 116,141 | 114,832 | 114,393 | 113,982 | 114,029 | 114,140 | 114,252 | 114,237 | 114,221 |
| Civil | 514 | 1,225 | 1,186 | 1,150 | 994 | 898 | 811 | 808 | 805 | 802 | 780 | 760 |
| Signalling & Telecoms | 3,276 | 7,250 | 7,284 | 7,325 | 6,705 | 6,366 | 6,044 | 5,996 | 5,952 | 5,938 | 5,893 | 5,850 |
| Electrical Supply | 976 | 1,669 | 1,616 | 1,563 | 1,350 | 1,221 | 1,100 | 1,071 | 1,041 | 1,021 | 993 | 967 |
| Railway Sections | 3,182 | 8,563 | 8,539 | 8,520 | 8,110 | 7,722 | 7,353 | 7,288 | 7,227 | 7,161 | 7,096 | 7,037 |
| **Total** | 81,155 | 374,801 | 368,815 | 363,154 | 349,870 | 345,385 | 345,477 | 348,695 | 352,024 | 353,899 | 355,418 | 355,751 |
| Change from prior year | | 361.8% | -1.6% | -1.5% | -3.7% | -1.3% | 0.0% | 0.9% | 1.0% | 0.5% | 0.4% | 0.1% |
| **Salary by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 1,606 | 2,958 | 3,043 | 3,128 | 2,753 | 2,424 | 2,133 | 2,128 | 2,121 | 2,117 | 2,112 | 2,107 |
| Freight & Commercial | 1,431 | 4,042 | 4,156 | 4,276 | 3,763 | 3,312 | 2,914 | 2,905 | 2,899 | 2,891 | 2,884 | 2,879 |
| Locomotive | 3,955 | 7,718 | 7,926 | 8,153 | 7,173 | 6,708 | 6,271 | 6,386 | 6,505 | 6,625 | 6,612 | 5,645 |
| Wagons | 1,174 | 2,552 | 2,624 | 2,699 | 2,376 | 2,222 | 2,076 | 2,094 | 2,109 | 2,128 | 2,121 | 2,117 |
| Track | 2,692 | 5,592 | 5,752 | 5,915 | 5,205 | 4,868 | 4,551 | 4,588 | 4,673 | 4,759 | 4,748 | 4,735 |
| Civil | 76 | 176 | 181 | 186 | 164 | 153 | 143 | 147 | 152 | 156 | 156 | 155 |
| Signalling & Telecoms | 1,254 | 2,626 | 2,700 | 2,779 | 2,445 | 2,285 | 2,136 | 2,131 | 2,127 | 2,142 | 2,138 | 2,134 |
| Electrical Supply | 98 | 224 | 231 | 237 | 208 | 195 | 182 | 182 | 181 | 183 | 182 | 182 |
| Railway Sections | 1,181 | 2,404 | 2,459 | 2,516 | 2,352 | 2,199 | 2,056 | 2,051 | 2,047 | 2,041 | 2,035 | 2,032 |
| **Total** | 13,467 | 28,292 | 29,072 | 29,889 | 26,440 | 24,366 | 22,463 | 22,611 | 22,815 | 23,043 | 22,987 | 21,987 |
| Change from prior year | | 110.1% | 2.8% | 2.8% | -11.5% | -7.8% | -7.8% | 0.7% | 0.9% | 1.0% | -0.2% | -4.4% |

TDY Railroad Operating Expenses Summary (In Millions of Manats)
PESSIMISTIC SCENARIO

| | Actual | Projected | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Employment by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 2,193 | 2,144 | 2,005 | 1,874 | 1,499 | 1,200 | 960 | 912 | 866 | 823 | 782 | 743 |
| Freight & Commercial | 2,803 | 2,609 | 2,439 | 2,281 | 1,825 | 1,460 | 1,168 | 1,109 | 1,054 | 1,001 | 951 | 904 |
| Locomotive | 3,114 | 3,149 | 2,944 | 2,753 | 2,202 | 1,872 | 1,591 | 1,543 | 1,497 | 1,452 | 1,380 | 1,049 |
| Wagons | 1,748 | 1,764 | 1,649 | 1,542 | 1,234 | 1,049 | 891 | 856 | 821 | 789 | 749 | 712 |
| Track | 4,630 | 4,743 | 4,435 | 4,146 | 3,317 | 2,820 | 2,397 | 2,301 | 2,232 | 2,165 | 2,057 | 1,954 |
| Civil | 935 | 822 | 769 | 719 | 575 | 489 | 415 | 407 | 399 | 391 | 371 | 353 |
| Signalling & Telecoms | 1,654 | 1,657 | 1,549 | 1,449 | 1,159 | 985 | 837 | 795 | 756 | 725 | 689 | 655 |
| Electrical Supply | 443 | 452 | 423 | 395 | 316 | 269 | 228 | 217 | 206 | 198 | 188 | 179 |
| Railway Sections | 1,710 | 1,695 | 1,576 | 1,466 | 1,246 | 1,059 | 900 | 855 | 813 | 772 | 733 | 697 |
| **Total** | 19,230 | 19,035 | 17,789 | 16,625 | 13,373 | 11,203 | 9,387 | 8,995 | 8,644 | 8,316 | 7,900 | 7,246 |
| Change from prior year | | -1.0% | -6.5% | -6.5% | -19.6% | -16.2% | -16.2% | -4.2% | -3.9% | -3.8% | -5.0% | -8.3% |
| Non Signalling & Telecoms Employees | 17,576 | 17,378 | 16,240 | 15,176 | 12,214 | 10,218 | 8,550 | 8,200 | 7,888 | 7,591 | 7,211 | 6,591 |
| **Social Insurance** | | | | | | | | | | | | |
| Passenger Service | 450 | 887 | 913 | 939 | 826 | 727 | 640 | 638 | 636 | 635 | 634 | 632 |
| Freight & Commercial | 401 | 1,213 | 1,247 | 1,283 | 1,129 | 993 | 874 | 872 | 870 | 867 | 865 | 864 |
| Locomotive | 1,107 | 2,315 | 2,378 | 2,446 | 2,152 | 2,012 | 1,881 | 1,916 | 1,952 | 1,988 | 1,984 | 1,694 |
| Wagons | 329 | 715 | 787 | 810 | 713 | 667 | 623 | 628 | 633 | 638 | 636 | 635 |
| Track | 757 | 1,678 | 1,726 | 1,774 | 1,562 | 1,460 | 1,365 | 1,376 | 1,402 | 1,428 | 1,424 | 1,421 |
| Civil | 21 | 53 | 54 | 56 | 49 | 46 | 43 | 44 | 46 | 47 | 47 | 47 |
| Signalling & Telecoms | 351 | 788 | 810 | 834 | 733 | 686 | 641 | 639 | 638 | 643 | 641 | 640 |
| Electrical Supply | 27 | 67 | 69 | 71 | 63 | 59 | 55 | 55 | 54 | 55 | 55 | 55 |
| Railway Sections | 331 | 721 | 738 | 755 | 706 | 660 | 617 | 615 | 614 | 612 | 611 | 610 |
| **Total** | 3,774 | 8,437 | 8,722 | 8,967 | 7,932 | 7,310 | 6,739 | 6,783 | 6,845 | 6,913 | 6,896 | 6,596 |
| Change from prior year | | 123.6% | 3.4% | 2.8% | -11.5% | -7.8% | -7.8% | 0.7% | 0.9% | 1.0% | -0.2% | -4.4% |
| **Materials by Operation Unit** | | | | | | | | | | | | |
| Passenger Service | 978 | 1,190 | 1,250 | 1,312 | 1,378 | 1,446 | 1,519 | 1,595 | 1,674 | 1,758 | 1,846 | 1,938 |
| Freight & Commercial | 81 | 346 | 346 | 348 | 349 | 352 | 355 | 358 | 361 | 363 | 366 | 369 |
| Locomotive | 7,043 | 17,000 | 16,290 | 15,757 | 15,049 | 15,002 | 15,270 | 15,543 | 15,820 | 16,101 | 16,386 | 16,676 |
| Wagons | 123 | 460 | 465 | 469 | 474 | 479 | 483 | 488 | 493 | 498 | 503 | 508 |
| Track | 1,384 | 3,862 | 3,862 | 3,862 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 | 3,476 |
| Civil | 20 | 76 | 73 | 69 | 60 | 53 | 48 | 47 | 46 | 46 | 44 | 43 |
| Signalling & Telecoms | 71 | 220 | 216 | 213 | 202 | 195 | 187 | 185 | 183 | 181 | 179 | 176 |
| Electrical Supply | 61 | 472 | 451 | 430 | 370 | 331 | 296 | 286 | 276 | 268 | 259 | 250 |
| Railway Sections | 282 | 502 | 493 | 485 | 466 | 449 | 432 | 427 | 421 | 416 | 411 | 406 |
| **Total** | 10,043 | 24,128 | 23,445 | 22,945 | 21,823 | 21,783 | 22,066 | 22,404 | 22,750 | 23,107 | 23,470 | 23,842 |
| Change from prior year | | 140.2% | -2.8% | -2.1% | -4.9% | -0.2% | 1.3% | 1.5% | 1.5% | 1.6% | 1.6% | 1.6% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**PESSIMISTIC SCENARIO**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Fuel by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 139 | 334 | 337 | 340 | 314 | 290 | 268 | 273 | 278 | 283 | 289 | 294 |
| Freight & Commercial | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Locomotive | 9,743 | 18,900 | 18,905 | 18,322 | 17,572 | 17,149 | 17,612 | 18,086 | 18,570 | 19,063 | 19,566 | 20,077 |
| Wagons | 103 | 242 | 233 | 223 | 197 | 179 | 163 | 159 | 155 | 151 | 147 | 143 |
| Track | 176 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 | 570 |
| Civil | - | - | - | - | - | - | - | - | - | - | - | - |
| Signalling & Telecoms | 15 | 26 | 26 | 25 | 24 | 23 | 22 | 22 | 22 | 21 | 21 | 21 |
| Electrical Supply | 1 | - | - | - | - | - | - | - | - | - | - | - |
| Railway Sections | 6 | 14 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 |
| **Total** | 10,185 | 20,088 | 20,086 | 19,497 | 18,692 | 18,226 | 18,650 | 19,124 | 19,609 | 20,103 | 20,606 | 21,118 |
| Change from prior year | | 97.2% | 0.0% | -2.9% | -4.1% | -2.5% | 2.3% | 2.5% | 2.5% | 2.5% | 2.5% | 2.5% |
| **Power Supply by Operation Unit** | | | | | | | | | | | | |
| Passenger Service | 45 | 152 | 153 | 155 | 143 | 132 | 122 | 124 | 127 | 129 | 131 | 134 |
| Freight & Commercial | 232 | 1,312 | 1,312 | 1,315 | 1,316 | 1,320 | 1,323 | 1,327 | 1,330 | 1,334 | 1,337 | 1,341 |
| Locomotive | 445 | 592 | 586 | 581 | 574 | 572 | 572 | 573 | 574 | 574 | 575 | 575 |
| Wagons | 109 | 432 | 415 | 399 | 351 | 320 | 291 | 284 | 277 | 270 | 262 | 254 |
| Track | 103 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 | 294 |
| Civil | 10 | 14 | 13 | 13 | 11 | 10 | 9 | 9 | 9 | 8 | 8 | 8 |
| Signalling & Telecoms | 355 | 1,042 | 1,025 | 1,008 | 958 | 922 | 887 | 876 | 866 | 857 | 846 | 836 |
| Electrical Supply | - | - | - | - | - | - | - | - | - | - | - | - |
| Railway Sections | 66 | 144 | 141 | 139 | 134 | 129 | 124 | 122 | 121 | 119 | 118 | 116 |
| **Total** | 1,365 | 3,982 | 3,941 | 3,903 | 3,781 | 3,698 | 3,622 | 3,609 | 3,596 | 3,586 | 3,572 | 3,558 |
| Change from prior year | | 191.7% | -1.0% | -1.0% | -3.1% | -2.2% | -2.0% | -0.4% | -0.4% | -0.3% | -0.4% | -0.4% |
| **Depreciation by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 743 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 | 42,000 |
| Freight & Commercial | 82 | 164 | 164 | 164 | 164 | 164 | 165 | 165 | 165 | 165 | 166 | 166 |
| Locomotive | 2,083 | 89,936 | 82,404 | 75,340 | 67,851 | 65,583 | 66,154 | 66,735 | 67,329 | 67,934 | 68,551 | 69,181 |
| Wagons | 2,560 | 25,937 | 27,900 | 30,060 | 31,890 | 33,423 | 34,955 | 36,487 | 38,020 | 38,020 | 38,020 | 38,020 |
| Track | 5,499 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 | 88,088 |
| Civil | 77 | 154 | 147 | 140 | 121 | 108 | 97 | 95 | 94 | 93 | 89 | 86 |
| Signalling & Telecoms | 633 | 1,272 | 1,251 | 1,231 | 1,169 | 1,126 | 1,083 | 1,070 | 1,057 | 1,046 | 1,033 | 1,020 |
| Electrical Supply | 144 | 290 | 277 | 264 | 227 | 204 | 182 | 176 | 169 | 165 | 159 | 154 |
| Railway Sections | 54 | 108 | 106 | 104 | 100 | 97 | 93 | 92 | 91 | 90 | 88 | 87 |
| **Total** | 11,875 | 247,948 | 242,337 | 237,391 | 231,611 | 230,792 | 232,816 | 234,908 | 237,012 | 237,599 | 238,193 | 238,801 |
| Change from prior year | | 1988.0% | -2.3% | -2.0% | -2.4% | -0.4% | 0.9% | 0.9% | 0.9% | 0.2% | 0.3% | 0.3% |

**TDY Railroad Operating Expenses Summary (in Millions of Manats)**
**PESSIMISTIC SCENARIO**

| | Actual | Projected | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Repair Fund & Other Expenses by Operating Unit** | | | | | | | | | | | | |
| Passenger Service | 3,087 | 1,188 | 1,247 | 1,310 | 1,375 | 1,444 | 1,516 | 1,592 | 1,672 | 1,755 | 1,843 | 1,935 |
| Freight & Commercial | 456 | 1,438 | 1,438 | 1,453 | 1,460 | 1,480 | 1,500 | 1,520 | 1,540 | 1,560 | 1,581 | 1,602 |
| Locomotive | 5,711 | 12,320 | 11,671 | 11,064 | 10,385 | 10,192 | 10,270 | 10,349 | 10,429 | 10,511 | 10,594 | 10,678 |
| Wagons | 10,860 | 4,028 | 4,068 | 4,109 | 4,150 | 4,192 | 4,233 | 4,276 | 4,319 | 4,362 | 4,405 | 4,449 |
| Track | 7,518 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 | 15,638 |
| Civil | 310 | 752 | 718 | 685 | 589 | 528 | 472 | 465 | 459 | 452 | 436 | 421 |
| Signalling & Telecoms | 597 | 1,276 | 1,255 | 1,235 | 1,173 | 1,129 | 1,087 | 1,073 | 1,060 | 1,049 | 1,036 | 1,023 |
| Electrical Supply | 645 | 616 | 588 | 561 | 483 | 432 | 386 | 373 | 360 | 350 | 338 | 326 |
| Railway Sections | 1,262 | 4,670 | 4,588 | 4,508 | 4,339 | 4,176 | 4,019 | 3,969 | 3,920 | 3,871 | 3,822 | 3,775 |
| **Total** | 30,446 | 41,926 | 41,213 | 40,563 | 39,592 | 39,210 | 39,121 | 39,255 | 39,397 | 39,549 | 39,693 | 39,848 |
| Change from prior year | | 37.7% | -1.7% | -1.6% | -2.4% | -1.0% | -0.2% | 0.3% | 0.4% | 0.4% | 0.4% | 0.4% |

TURKMENISTAN RAILWAYS
PESSIMISTIC SCENARIO
FREIGHT TRAFFIC & REVENUE FORECASTS

| Tonnage by Commodity (Thousands Tonnes) | Actual 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | Projected 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Petroleum Products | 4293 | 4,379 | 4,466 | 4,556 | 4,647 | 4,740 | 4,835 | 4,931 | 5,030 | 5,131 | 5,233 | 5,338 |
| Growth % | | 2% | 2% | 2% | 2.0% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Construction Materials | 4424 | 4,512 | 4,603 | 4,695 | 4,789 | 4,884 | 4,982 | 5,082 | 5,183 | 5,287 | 5,393 | 5,501 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Fertilisers | 813 | 829 | 846 | 863 | 880 | 898 | 916 | 934 | 953 | 972 | 991 | 1,011 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Cement | 622 | 634 | 647 | 660 | 673 | 687 | 700 | 714 | 729 | 743 | 758 | 773 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Cotton | 352 | 359 | 366 | 374 | 381 | 389 | 396 | 404 | 412 | 421 | 429 | 438 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Other | 5399 | 5,507 | 5,617 | 5,729 | 5,844 | 5,961 | 6,080 | 6,202 | 6,326 | 6,452 | 6,581 | 6,713 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Total | 15903 | 16,221 | 16,545 | 16,876 | 17,214 | 17,558 | 17,909 | 18,268 | 18,633 | 19,006 | 19,386 | 19,773 |

| Tonne Kilometres by Commodity (Millions Tonne Kilometres) | Actual 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | Projected 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Petroleum Products | 2,578 | 2,630 | 2,683 | 2,736 | 2,791 | 2,847 | 2,904 | 2,962 | 3,021 | 3,081 | 3,143 | 3,206 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Construction Materials | 1,496 | 1,526 | 1,556 | 1,587 | 1,619 | 1,651 | 1,684 | 1,718 | 1,753 | 1,788 | 1,823 | 1,860 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Fertilisers | 119 | 121 | 124 | 126 | 129 | 131 | 134 | 136 | 139 | 142 | 145 | 148 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Cement | 216 | 220 | 225 | 229 | 234 | 238 | 243 | 248 | 253 | 258 | 263 | 268 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Cotton | 162 | 165 | 169 | 172 | 176 | 179 | 183 | 186 | 190 | 194 | 198 | 202 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Other | 2,432 | 2,480 | 2,530 | 2,581 | 2,632 | 2,685 | 2,738 | 2,793 | 2,849 | 2,906 | 2,964 | 3,023 |
| Growth % | | 2% | 2% | 2% | 2% | 2% | 2% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Total | 7,003 | 7,143 | 7,286 | 7,431 | 7,580 | 7,732 | 7,886 | 8,044 | 8,205 | 8,369 | 8,536 | 8,707 |
| **Average Length of Haul** | | | | | | | | | | | | |
| Petroleum Products | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 | 600.6 |
| Construction Materials | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 | 338.1 |
| Fertilisers | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 | 146.1 |
| Cement | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 | 347.1 |
| Cotton | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 | 460.7 |
| Other | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 | 450.4 |
| Total | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 | 440.3 |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**FREIGHT TRAFFIC & REVENUE FORECASTS**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Revenue per tonne-km** | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| % real change from prior year | | 70.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Inflation | | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| Nominal % change from prior year | | 70.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Revenue per tonne-km | 19.7 | 33.4659 | 33.8005 | 34.1386 | 34.4799 | 34.8247 | 35.1730 | 35.5247 | 35.8800 | 36.2388 | 36.6011 | 36.9672 |
| **Revenue** | | | | | | | | | | | | |
| % collected in cash | 40.0% | 40.0% | 45.0% | 55.0% | 60.0% | 70.0% | 75.0% | 75.0% | 80.0% | 80.0% | 80.0% | 80.0% |
| % collected in barter | 40.0% | 40.0% | 35.0% | 30.0% | 25.0% | 20.0% | 15.0% | 15.0% | 15.0% | 15.0% | 15.0% | 15.0% |
| Barter conversion cost | | 20.0% | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* | *20.0%* |
| % bad debt | 20.0% | 20.0% | 20.0% | 15.0% | 15.0% | 10.0% | 10.0% | 10.0% | 5.0% | 5.0% | 5.0% | 5.0% |
| Cash (000,000) | 55,142 | 95,616 | 110,816 | 139,532 | 156,814 | 188,475 | 208,036 | 214,318 | 235,510 | 242,622 | 249,950 | 257,498 |
| Barter (000,000) | 55,142 | 95,616 | 86,190 | 76,108 | 65,339 | 53,850 | 41,607 | 42,864 | 44,158 | 45,492 | 46,866 | 48,281 |
| Barter conversion cost (000,000) | | 19,123 | 17,238 | 15,222 | 13,068 | 10,770 | 8,321 | 8,573 | 8,832 | 9,098 | 9,373 | 9,656 |
| Bad debt (000,000) | 27,571 | 47,808 | 49,252 | 38,054 | 39,203 | 26,925 | 27,738 | 28,576 | 14,719 | 15,164 | 15,622 | 16,094 |
| Total revenue (000,000) | 137,854 | 239,039 | 246,258 | 253,695 | 261,356 | 269,249 | 277,381 | 285,758 | 294,387 | 303,278 | 312,437 | 321,873 |
| % increase | | | | | | | | | | | | |
| Total revenue collected (000,000) | 110,283 | 191,231 | 197,006 | 215,641 | 222,153 | 242,324 | 249,643 | 257,182 | 279,668 | 288,114 | 296,815 | 305,779 |

**TURKMENISTAN RAILWAYS**
**PESSIMISTIC SCENARIO**
**PASSENGER TRAFFIC & REVENUE FORECASTS**

| | Actual | Projected | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| **Passenger-km** | | | | | | | | | | | | |
| Change from prior year | *12.1%* | *-54.6%* | *-14.8%* | *2.2%* | *-8.4%* | *10.0%* | *9.2%* | *8.6%* | *8.2%* | *7.6%* | *7.3%* | *6.9%* |
| Pass-km (000,000) | 2,103 | 954 | 813 | 831 | 761 | 837 | 914 | 993 | 1,074 | 1,156 | 1,240 | 1,325 |
| **Revenue per passenger-km** | | | | | | | | | | | | |
| % real change from prior year | 930.6% | 688.9% | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* | *1.0%* |
| Inflation | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* | *0.0%* |
| Nominal % change from prior year | 930.6% | 688.9% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% | 1.0% |
| Revenue per passenger-km | 3.5873 | 28.2989 | 28.5819 | 28.8677 | 29.1564 | 29.4480 | 29.7424 | 30.0399 | 30.3403 | 30.6437 | 30.9501 | 31.2596 |
| **Revenue** | 7,544 | 26,995 | 23,238 | 23,990 | 22,190 | 24,649 | 27,186 | 29,830 | 32,584 | 35,423 | 38,376 | 41,417 |

# Appendices

# Freight traffic : Development of market shares of the different modes between 1991 and 1996

| Tkm-performance of all transport modes (millions) | **1991** 34594,3 | **1992** 25552,6 | **1993** 20838,6 | **1994** 13928,5 | **1995** 9239,3 | **1996** 7620,5 |
|---|---|---|---|---|---|---|
| **out of which** | | | | | | |
| **railways** | **95,8 %** | **95,7 %** | **94,9 %** | **93,1 %** | **92,7 %** | **89,9 %** |
| | **33140** | **24457** | **19779** | **12972** | **8565** | **6852** |
| **road transport** | **1103** | **867** | **813** | **700,5** | **487,9** | **482,1** |
| **inland waterways** | **18,1** | **36,4** | **34,8** | **24,3** | **20,1** | **11,7** |
| **sea transport** | **-** | **-** | **-** | **-** | **120,8** | **253,7** |
| **air transport** | **332,5** | **192,2** | **211,8** | **231,7** | **45,5** | **21,0** |

## 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.

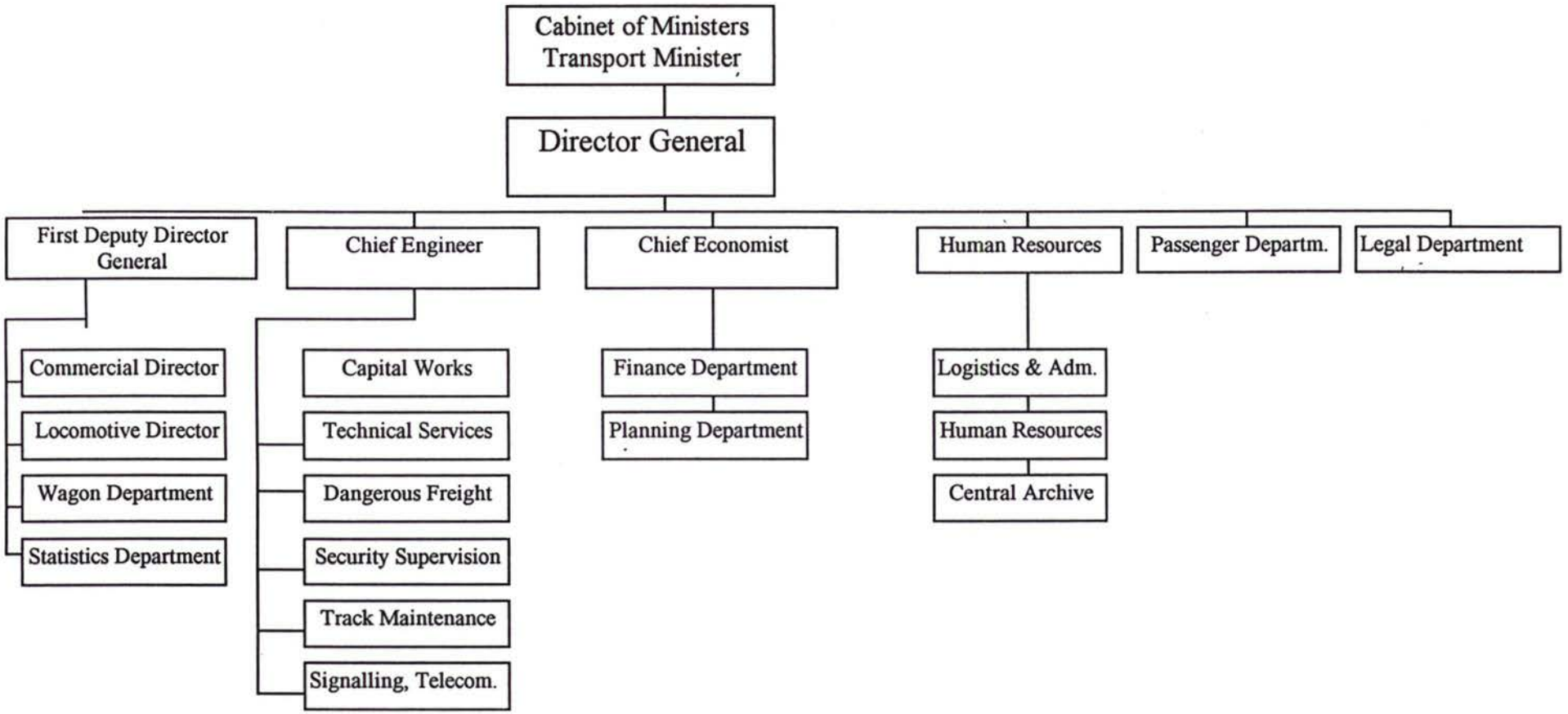
### 1.2.6 PERFORMANCE FACTORS

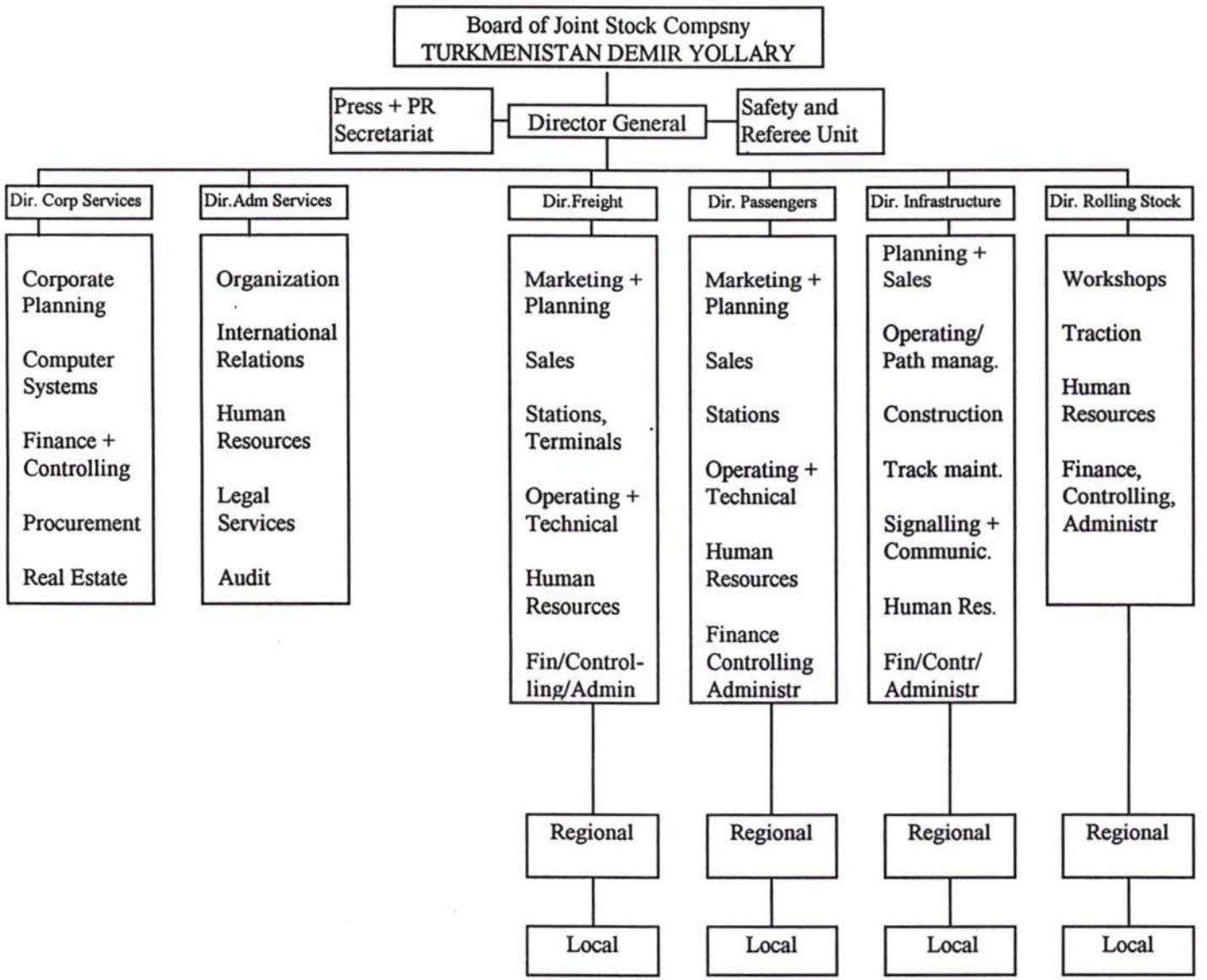
The investment will have the effect of reducing expenditure and of increasing revenue.

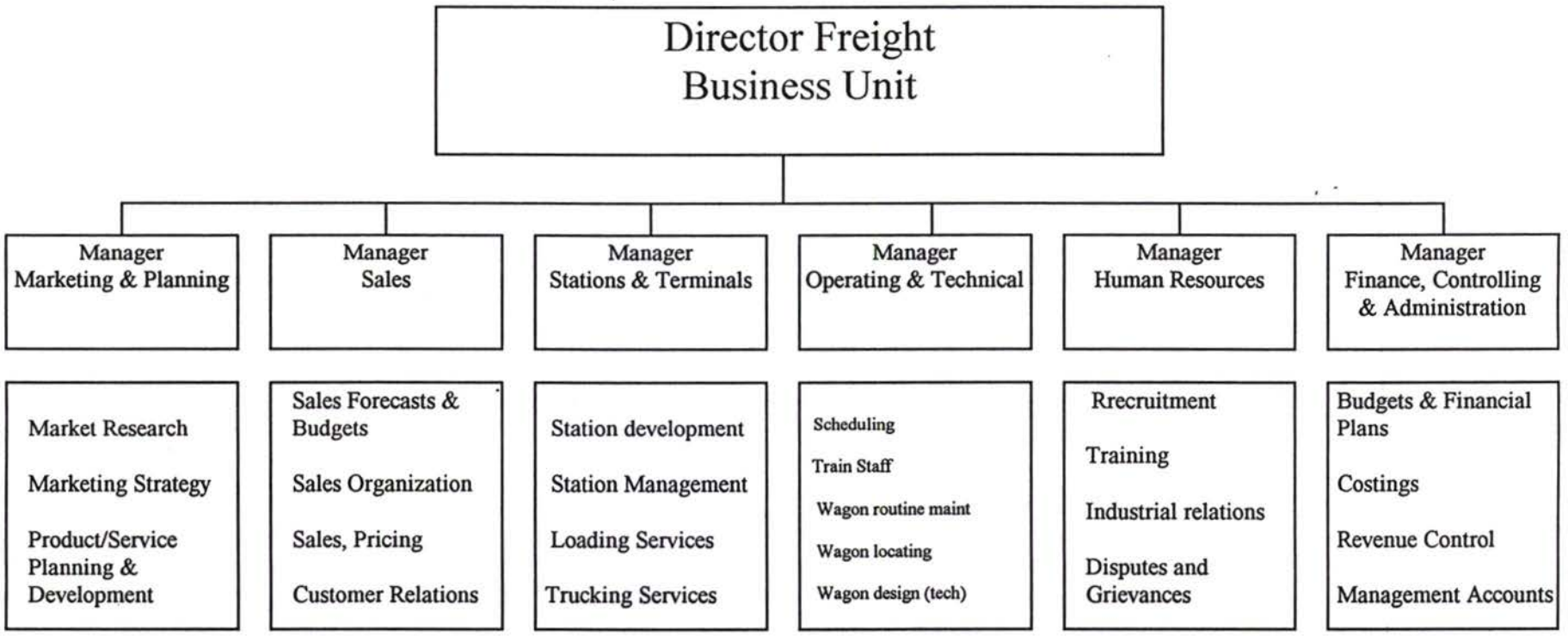
The Government for its part will expect a reduction in real expenditure which will be specified.

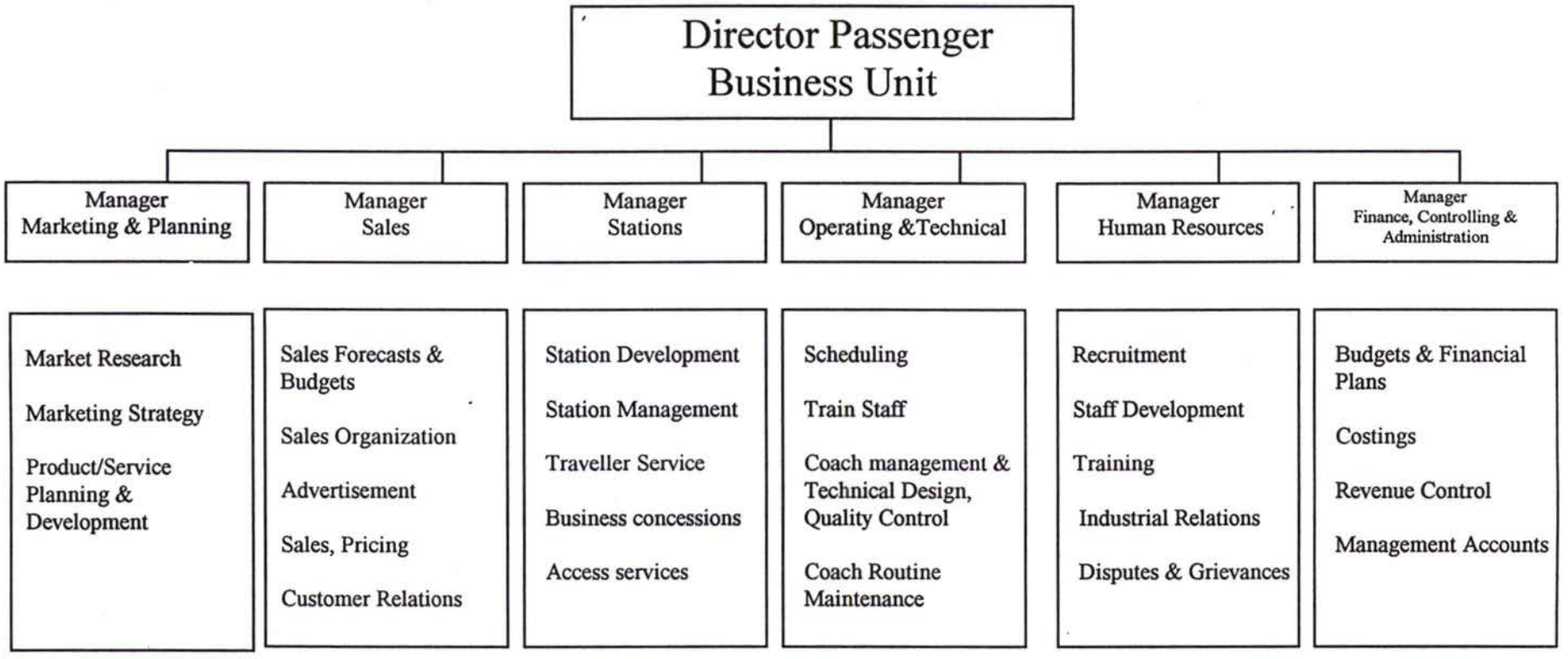
### 1.2.7 EXECUTION OF CONTRACT

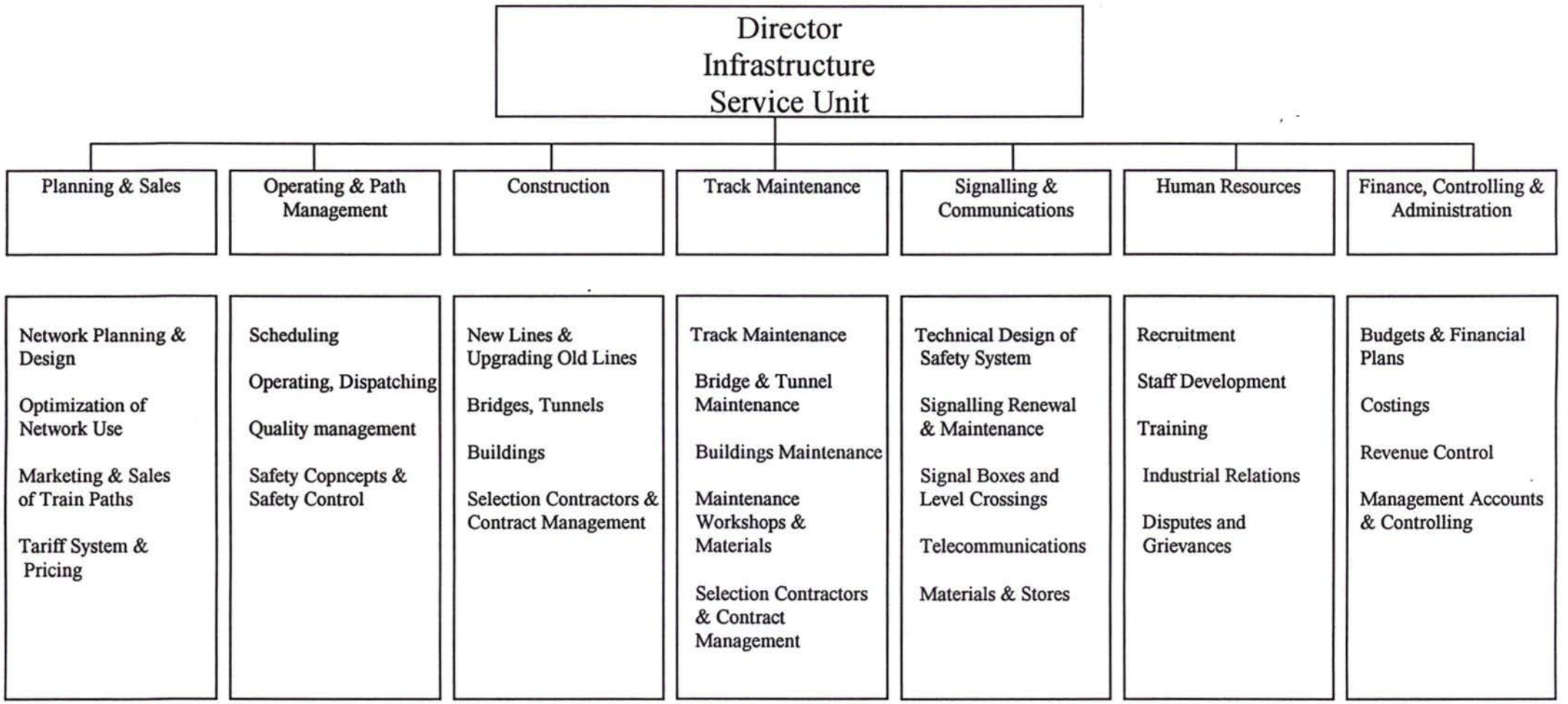
The Railway Enter prise will present to the Government each year details of their performance for the previous year and projections for the current year. The extent to which they succeeded in achieving the agreed targets will be examined and assessed. Action will be taken on any adjustments or corrections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


Cabinet of Ministers
Transport Minister
Director General
First Deputy Director General
Chief Engineer
Chief Economist
Human Resources
Passenger Departm.
Legal Department
Commercial Director
Locomotive Director
Wagon Department
Statistics Department
Capital Works
Technical Services
Dangerous Freight
Security Supervision
Track Maintenance
Signalling, Telecom.
Finance Department
Planning Department
Logistics & Adm.
Human Resources
Central Archive

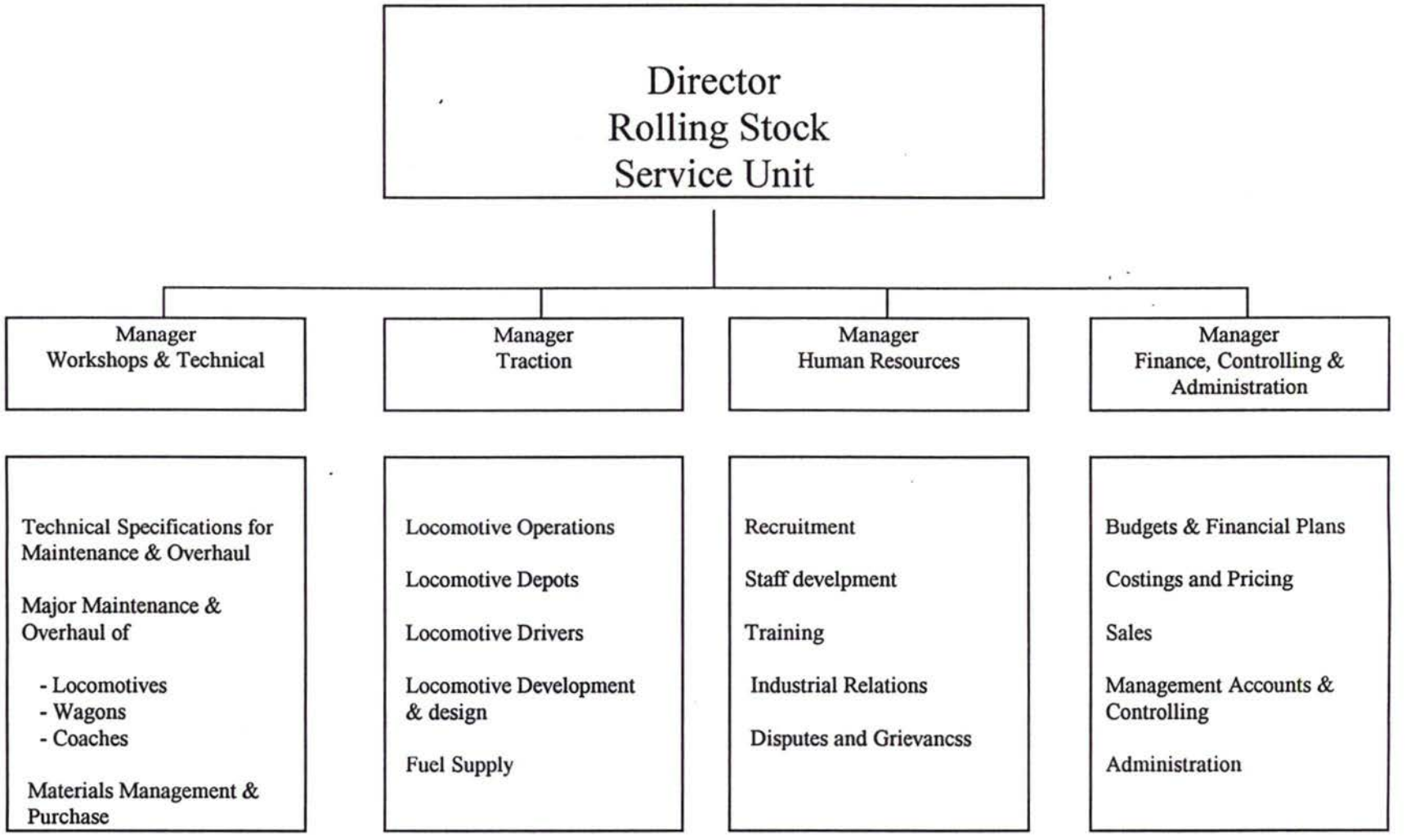

Board of Joint Stock Compsny
TURKMENISTAN DEMIR YOLLARY
Press + PR Secretariat
Director General
Safety and Referee Unit
Dir. Corp Services
Dir.Adm Services
Dir.Freight
Dir. Passengers
Dir. Infrastructure
Dir. Rolling Stock
Corporate Planning
Computer Systems
Finance + Controlling
Procurement
Real Estate
Organization
International Relations
Human Resources
Legal Services
Audit
Marketing + Planning
Sales
Stations, Terminals
Operating + Technical
Human Resources
Fin/Control-ling/Admin
Marketing + Planning
Sales
Stations
Operating + Technical
Human Resources
Finance Controlling Administr
Planning + Sales
Operating/ Path manag.
Construction
Track maint.
Signalling + Communic.
Human Res.
Fin/Contr/ Administr
Workshops
Traction
Human Resources
Finance, Controlling, Administr
Regional
Regional
Regional
Regional
Local
Local
Local
Local

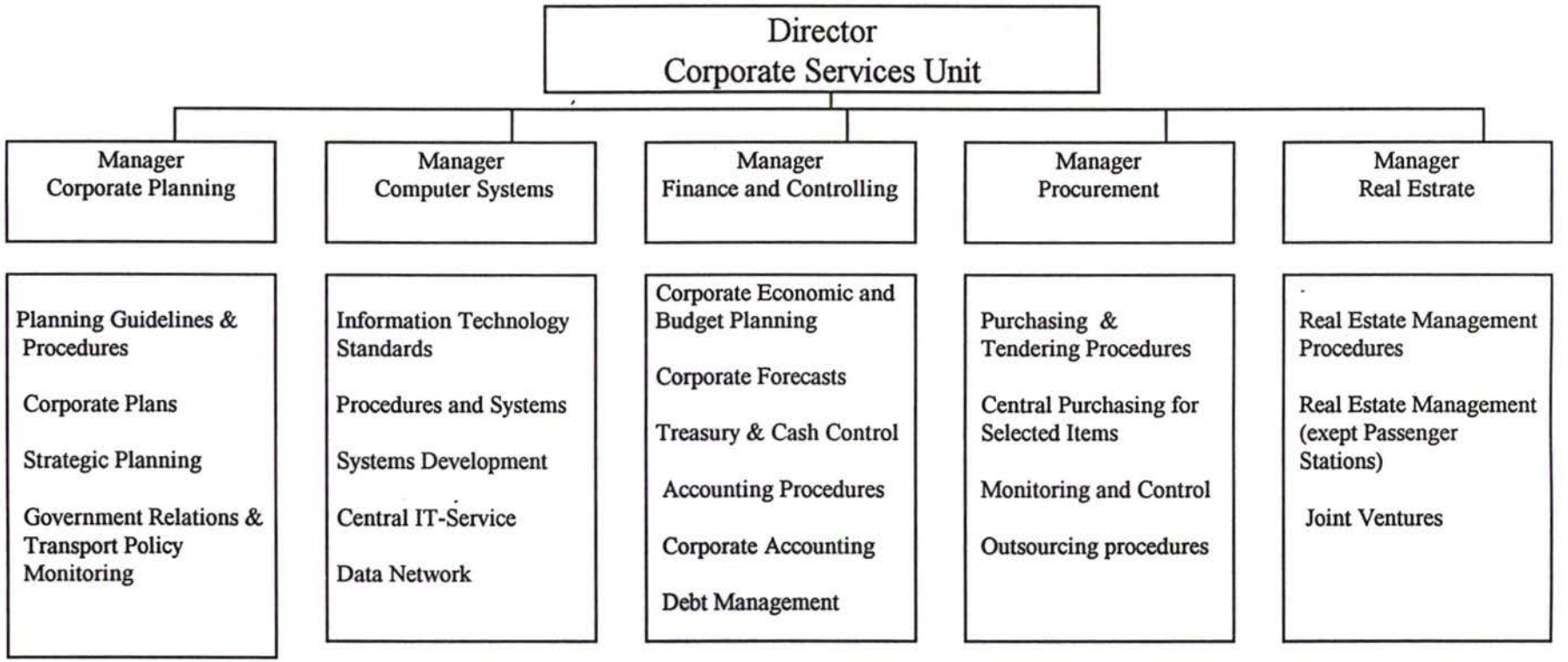

Director Freight
Business Unit
Manager
Marketing & Planning
Manager
Sales
Manager
Stations & Terminals
Manager
Operating & Technical
Manager
Human Resources
Manager
Finance, Controlling
& Administration
Market Research
Marketing Strategy
Product/Service
Planning &
Development
Sales Forecasts &
Budgets
Sales Organization
Sales, Pricing
Customer Relations
Station development
Station Management
Loading Services
Trucking Services
Scheduling
Train Staff
Wagon routine maint
Wagon locating
Wagon design (tech)
Rrecruitment
Training
Industrial relations
Disputes and
Grievances
Budgets & Financial
Plans
Costings
Revenue Control
Management Accounts

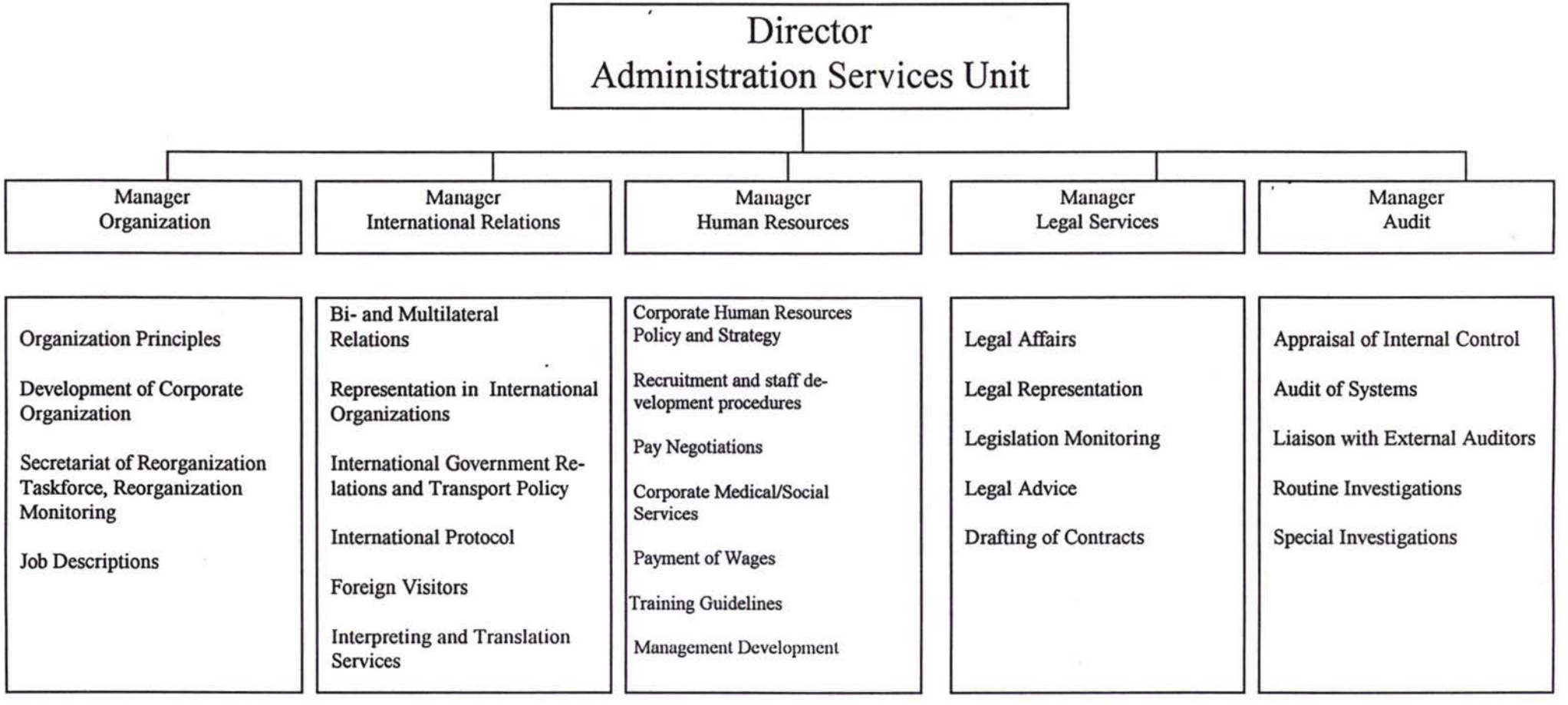

Director Passenger Business Unit
Manager Marketing & Planning
Manager Sales
Manager Stations
Manager Operating &Technical
Manager Human Resources
Manager Finance, Controlling & Administration
Market Research
Marketing Strategy
Product/Service Planning & Development
Sales Forecasts & Budgets
Sales Organization
Advertisement
Sales, Pricing
Customer Relations
Station Development
Station Management
Traveller Service
Business concessions
Access services
Scheduling
Train Staff
Coach management & Technical Design, Quality Control
Coach Routine Maintenance
Recruitment
Staff Development
Training
Industrial Relations
Disputes & Grievances
Budgets & Financial Plans
Costings
Revenue Control
Management Accounts


Director
Infrastructure
Service Unit
Planning & Sales
Operating & Path Management
Construction
Track Maintenance
Signalling & Communications
Human Resources
Finance, Controlling & Administration
Network Planning & Design
Optimization of Network Use
Marketing & Sales of Train Paths
Tariff System & Pricing
Scheduling
Operating, Dispatching
Quality management
Safety Copncepts & Safety Control
New Lines & Upgrading Old Lines
Bridges, Tunnels
Buildings
Selection Contractors & Contract Management
Track Maintenance
Bridge & Tunnel Maintenance
Buildings Maintenance
Maintenance Workshops & Materials
Selection Contractors & Contract Management
Technical Design of Safety System
Signalling Renewal & Maintenance
Signal Boxes and Level Crossings
Telecommunications
Materials & Stores
Recruitment
Staff Development
Training
Industrial Relations
Disputes and Grievances
Budgets & Financial Plans
Costings
Revenue Control
Management Accounts & Controlling

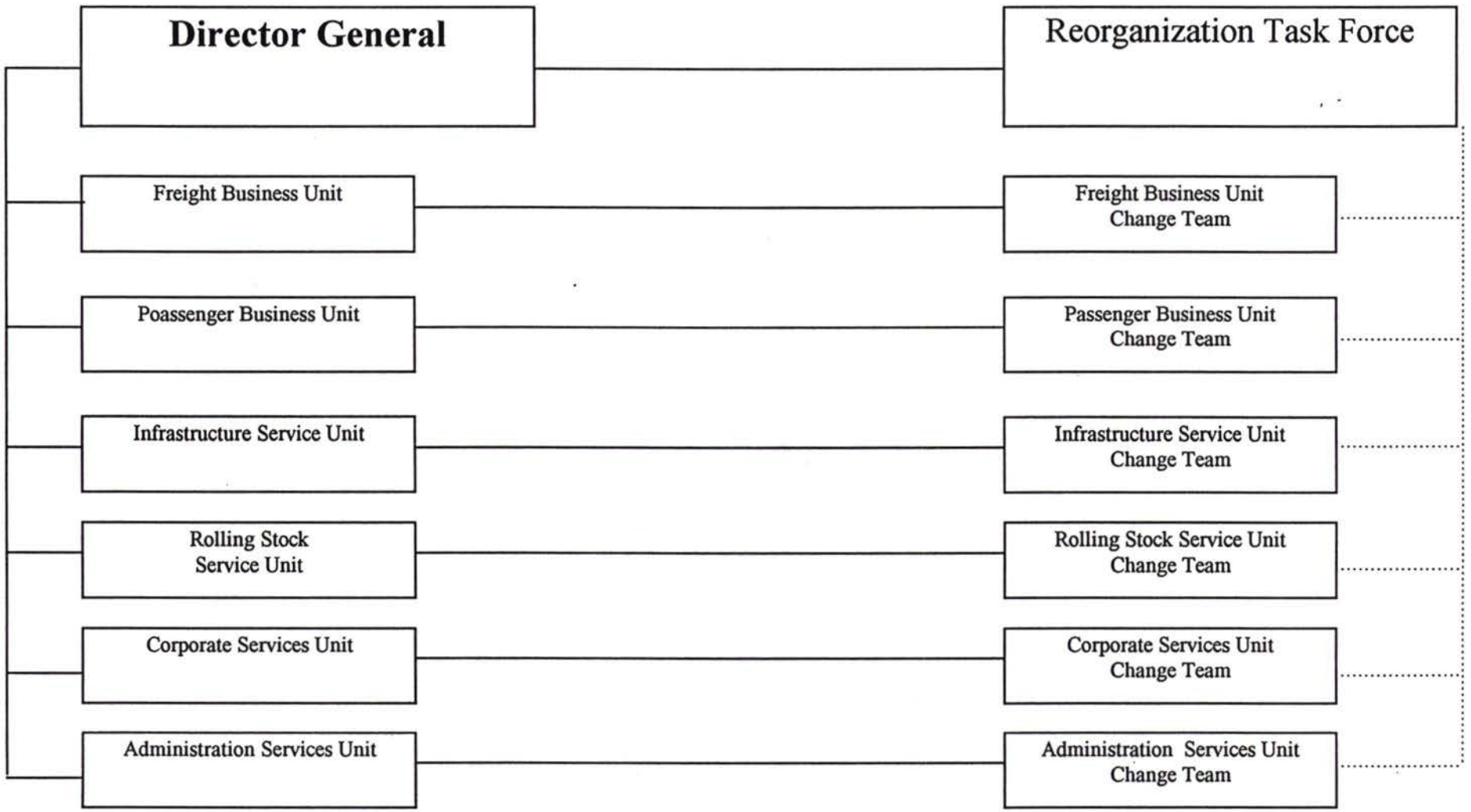
**Appendix 8**


Director
Rolling Stock
Service Unit
Manager
Workshops & Technical
Manager
Traction
Manager
Human Resources
Manager
Finance, Controlling & Administration
Technical Specifications for Maintenance & Overhaul
Major Maintenance & Overhaul of
- Locomotives
- Wagons
- Coaches
Materials Management & Purchase
Locomotive Operations
Locomotive Depots
Locomotive Drivers
Locomotive Development & design
Fuel Supply
Recruitment
Staff develpment
Training
Industrial Relations
Disputes and Grievancss
Budgets & Financial Plans
Costings and Pricing
Sales
Management Accounts & Controlling
Administration


Director
Corporate Services Unit
Manager
Corporate Planning
Manager
Computer Systems
Manager
Finance and Controlling
Manager
Procurement
Manager
Real Estrate
Planning Guidelines & Procedures
Corporate Plans
Strategic Planning
Government Relations & Transport Policy Monitoring
Information Technology Standards
Procedures and Systems
Systems Development
Central IT-Service
Data Network
Corporate Economic and Budget Planning
Corporate Forecasts
Treasury & Cash Control
Accounting Procedures
Corporate Accounting
Debt Management
Purchasing & Tendering Procedures
Central Purchasing for Selected Items
Monitoring and Control
Outsourcing procedures
Real Estate Management Procedures
Real Estate Management (exept Passenger Stations)
Joint Ventures


Director
Administration Services Unit
Manager
Organization
Manager
International Relations
Manager
Human Resources
Manager
Legal Services
Manager
Audit
Organization Principles
Development of Corporate Organization
Secretariat of Reorganization Taskforce, Reorganization Monitoring
Job Descriptions
Bi- and Multilateral Relations
Representation in International Organizations
International Government Relations and Transport Policy
International Protocol
Foreign Visitors
Interpreting and Translation Services
Corporate Human Resources Policy and Strategy
Recruitment and staff development procedures
Pay Negotiations
Corporate Medical/Social Services
Payment of Wages
Training Guidelines
Management Development
Legal Affairs
Legal Representation
Legislation Monitoring
Legal Advice
Drafting of Contracts
Appraisal of Internal Control
Audit of Systems
Liaison with External Auditors
Routine Investigations
Special Investigations

# Reorganization Implementation Structure



## A.1 THE TDY RAILWAY BACKGROUND

With the break-up of the Soviet Union Turkmenistan inherited a vast well-maintained railway plant. Under the Soviet System, railways such as Turkmenistan's were considered to be a strategic asset as well as an asset important for the national economic development. The railways were built to high standards and operated under a structured management system. Operating and communication systems were designed in several layers of redundancy to make them fail-safe. There was a high degree of standardisation of facilities and equipment and a very high level of discipline in railway operations.

## A.2 THE RAILWAY NETWORK

TDY operates a railway system of 2,312 kilometres. 33 kilometres are double track lines, 2,249 kilometres are single track lines. The gauge is 1,520 millimetres. No lines are electrified. The main line follows a west - east direction and links Turkmenbashi at the Caspian Sea with Chardjev at the border to Uzbekistan via Ashgabat, the capital of Turkmenistan and Mary, an industry town. The main line is part of the TRACECA corridor.

Other lines are:

- a link to the Afghanistan border (Mary to Gyshgy)
- a link with Kazakstan and Russia (Chardjev - Darganata - Gazodjak - Dashhaouz). This line is following the Uzbekistan border and crosses it at several points
- a link with Uzbekistan (Chardjev-Feder)
- a link from Uzbekistan to Tadjikistan crossing Turkmenistan
- a link to Iran (Tedjen-Sarakhs). This line was opened on May 13th 1996 and gives TDY an access to the Persian Gulf port of Bandar-Abbas at the Persian Gulf and through Turkey onward towards Western Europe. Iran Railways is operating on a gauge of 1,435 millimetres. Therefore transhipment has to be performed at the border station, Sarakhs. Transportation figures on this line have risen significantly in 1997. The line has a length of 130 kilometres.

The network is composed of 171 stations of which :

- 139 are small stations with less than 15 switches
- 23 are medium size stations with 15 to 60 switches
- 9 are large stations with more than 60 switches

142 stations are equipped with electric switch points.

It is an interesting fact that the terminal station of Turkmenbasi has never been equipped with electric switch points due to water level problems. The tracks are often flooded.

Like in many others of the C.I.S. countries, in Turkmenistan the network does not always meet the demands of the new republics. Part of the lines run though the territory of the neighbouring countries. In Turkmenistan the line from Chardjev to Dashowuz several time crosses the border to Uzbekistan. For using the Uzbek track, TDY has to pay utilisation charges, which have to be paid in Swiss Francs.
On the other side of the border, the Uzbek railway authority is constructing a line that runs parallel to the Turkmen border for reason of avoiding Turkmen territory and utilisation fees.

## A.3 MODE OF OPERATION

The mode of operation in TDY is based on the standards set during the time of the Soviet Union with the following exceptions:

- Moscow time is no longer used in the schedules; the timetables are based on Turkmenistan time (GMT + 5:00)

- The Moscow based central passenger reservation system "Express 2" is obviously no longer used

All other standards and rules for railway operations, for train configuration, marshalling, operation control and timetable planning methods etc. are still based on the rules valid prior to independence.

Traffic is controlled and co-ordinated by the Central Traffic Control Centre. The Central Traffic Control is located in the building of the TDY headquarters in Ashgabat. From here, the rail operations in the entire network are controlled. Large stations have individual signal boxes. Small wayside stations are equipped with control panels. In case of failure of the Central Traffic Control local operation from these panels is possible.

Approximately 80% of the TDY lines are equipped with multi-aspect colour light signals, track vacancy detection systems and electric switching points. All railway stations and passing loops have at least two passing tracks.

Shunting operations within station limits and in marshalling yards is locally controlled. These movements are negotiated between the station's operator and the dispatcher. The local operator sets the routes for the shunting movements.

Larger stations, such as Ashgabat, Mary and Chardjev are controlled locally.

## A.4 ORGANISATION AND STAFFING

The Railway headquarters are located in Ashgabat. The first Deputy to the Director General is responsible for operations. Chief Traffic security officer is responsible for track maintenance signalling and telecommunication.

The network is divided into 5 regional centres, which are responsible for their part of the network. These regional centres are:

- Ashgabat
- Amurdarya
- Chardjev
- Mary
- Turkmenbashi

The department of Human Resources is responsible for all staff and personnel matters in the railways. The total staff in TDY on 1. August 1997 was 21.273 persons.

The development of personnel related to operation services is given below:

| Service | Staff Numbers | | |
|---|---|---|---|
| | 1-1-1991 | 1-12-1996 | 1-8-1997 |
| Passenger | 1,551 | 1,826 | 1,716 |
| Operating | 2,858 | 2,685 | 2,672 |
| Freight Handling | 769 | 384 | 386 |
| **Total:** | **3,187** | **2,888** | **2,770** |

Table 1 ; Development of staff in operation related services

Small stations are usually staffed with 1 or two personnel, medium stations with up to 60 and larger stations with up to 130 personnel. The table shows, that the development of staff does not mirror the general decline of transportation figures.

Operation personnel at the control centre, at stations and in marshalling yards usually work in twelve hours shifts.

## A.5 SAFETY

There is no doubt that TDY is a very safe railway and has a very good safety record. TDY ensures, that it operates to standards laid down by the ministry, that rules and regulations are properly observed, that technical engineering standards are properly certified, that all equipment, installations and facilities meet agreed qualities and that the staff is competent.

Safety procedures and supervisions are clearly laid down. There are comprehensive books of rules, regulations and instructions and the areas of responsibility and required knowledge for each grade or post are well defined. A booklet lays down the groups of personnel by which testing committees should be formed. The groups of grade and the posts that should be examined are clearly defined, as well as the frequency in which such examinations should be conducted. Records of tests have to be kept.

There are standard instructions covering the procedures for conducting investigations on accidents.

The basic rules and regulations TDY is presently observing are the ones applied by the Ministry of Railways in Moscow.

## A.6 TRAIN OPERATION

The network is equipped with colour light signals and electric switching points, except hand operated areas. The average length of a block section is 2,500 metres. The average distance on the main lines between stations is approximately 10 – 15 kilometres. All wayside stations have at least two loop tracks.

In large stations a local control signal box controls all train movements.

Almost the entire network is under command of a Centralised Traffic Control System (CTC) and has an automatic or semi- automatic block system. In case of central control failures, local mode operation is possible in every railway station.

The traffic on all lines is controlled from the Central Traffic Control Centre located in the headquarters buiding at Ashgabat.

Operation of the control system is organised in three levels:

| | |
|---|---|
| Central Traffic Controllers: | are in charge of overall traffic control |
| Controllers at major stations: | are in charge of traffic in their stations |
| Panel Operators at wayside stations: | are operating local equipment of the station in case of CTC failures on behalf of the Traffic Controller |

The lines of the network are divided into ten control districts. The following table shows the control districts:

| CONTROL DISTRICTS |
|---|

| District No. | From | To |
|---|---|---|
| 1 | Krasnovodsk | Bami |
| 2 | Bami | Ashgabat |
| 3 | Ashgabat | Dushak |
| 4 | Dushak | Mary |
| 5 | Mary | Chardzhev – (Serakhs) |
| 6 | Chardzhev | Dargan-Ata |
| 7 | Dargan-Ata | Gazachak |
| 8 | Razezd 449 | Takhiatash |
| 9 | Mary | Kushka |
| 10 | Razezd 161 | Talimardzhan |

Table 2; Central traffic control district

The Central Traffic Control Centre uses equipment of the following types of equipment::

- NEVA, built 1970, relay based equipment
- LUCH, electronic equipment

The central controllers record the train runs on train graphs using different colour pens for different categories of trains. Basis for the train runs is the so called Master Graph. In former times the master graph was published in printed form and contained all trains scheduled to run in the system. Now the Master Graph is hand drawn and contains only passenger trains. Goods trains are not running according to a schedule.

The central controllers announce their dispositions to the local controllers at the major stations.

The wayside stations are equipped with control panels, from where the stations can be operated in case of failure of the CTC system. An employee who lives at the relevant station then takes over local control.

## A.7 OPERATION KEY PARAMETERS

### A.7.1 Maximum speed and speed restrictions

There are two categories of maximum speeds:

- 100 kph for passenger trains
- 80 kph for goods trains

On main tracks, a 40 km/h speed restriction is applied to pass switching points in diverging direction.

In addition to this general restriction, there are two types of locally applied speed restrictions:

- permanent speed restrictions
- temporary speed restrictions

The permanent speed restrictions are published in a booklet that is valid for the duration of the timetable period. The temporary speed restrictions are introduced on the spot in case of track failures, maintenance activities or other related reasons.

At present on the entire network, there are 40 sections with speed restrictions, restricting the speed in a range from 90 km/h to 40 km/h. The longest sections in the network are 20 km, 17 and 18 km, all between Mary and Kushka. Altogether 150 km of the network have speed restrictions, which amounts to about 6% of entire lines.

### A.7.2 Axle Load, Train Lengths Train Loads

The maximum permissible axle load is 23 tons. The maximum train load is 3600 tons. The maximum number of wagons is 60 wagons for goods trains and 23 coaches for passenger trains. Maximum train length is 850 metres.

The length of loop tracks is between 850, 1050 and 1500 m for large stations.

Maximum speeds for rolling stock can be seen in the following table.

| Type of Rolling Stock | Sate of Loading | maximum speed |
|---|---|---|
| goods wagons | loaded | 90 kmph |
| | empty | 100 kmph |
| refrigerator wagons | loaded/empty | 120 kmph |
| passenger coaches | | 100 kmph – 160 kmph |
| locomotives | | 100 km/h plus a 15% reserve |

Table 3 ; Maximum speed of rolling stock

### A.7.3 Signalling equipment

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

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

### A.7.4 Block System

The distance between two stations is divided into block sections, which do not exceed 2.5 kilometres. On double track sections, for operations on the wrong side of the track, trains run from station to station without intermediate signals.

The railway lines with automatic block system (station and open line) are equipped with 50 Hz track circuits (track release installation).

The automatic train running control (frequency impulses) transmits the aspect of the fixed signals to the driver's cabs through track circuits, which are coded.

### A.7.5 Automatic train running control

The automatic train running control system transmits the aspects of the signals into the driver's cab and automatically applies the train brakes, if the driver runs over a signal showing a halt aspect. This feature is available on main lines only.

### A.7.6 Train Radio system

The main lines are equipped with a train radio system. It allows the driver to communicate with the central controller, station controllers and other locomotive drivers.

### A.7.7 Level Crossings

All level crossings are equipped with train operated automatic warning light signals. In addition some of the level crossings are equipped with automatic barriers. At some of the level crossing protecting signals, showing a blue light, when the level crossing is closed, are installed.

Some level crossings are guarded by a gateman. These gatemen are just watching the crossing. They have no facilities to interfere with train operations in case of emergency.

### A.7.8 Telecommunication Equipment

For operating and management purposes the following telecommunication infrastructure is installed:

- Central dispatcher to local operator (dispatching)
- Station operators along the line with each other (dispatching)
- Central dispatcher to locomotive drivers (radio communication with trains)

- Station inspectors to locomotive drivers (radio communication with trains)
- Locomotive drivers to each other (radio communication with trains)
- Shunting personnel to locomotive drivers and station operator (station radio)
- Party lines for permanent way maintenance staff
- Party lines for telecommunication and signalling maintenance staff
- Communication for remote control
- Local lines between two railway stations; these also include the telephones at the signals and turnouts at the entry and exit area.
- Administrative and managing communication for all the staff (private switching telephone network PSTN)
- Teleprinter links with other networks
- Data transmission links with the main railway stations and other railway networks
- Public address systems at larger stations
- Loudspeaker announcement systems at marshalling yards

## A.8 ROLLING STOCK

After the break up of the Soviet Union the rolling stock of the SZD was distributed among the railway administrations. This fact bears the advantage that all rolling stock can be used on the networks of the C.I.S. countries without technical and organisational problems.

On the other hand, the disadvantages of the rolling stock distribution exercise lie on hand:

- Wagons, coaches and locomotives have not always been distributed to the new republics' individual needs. A general traffic decline in the countries has eased the negative effects, but the fact that TDY owns 700 refrigerator wagons without hardly any need for them, makes the problems evident.

- The old spare part supply system is no longer existing. The manufacturers are either no longer producing, or spare parts have to be obtained against hard currency.

- Adequate maintenance facilities are not available for all types of equipment. In Turkmenistan this applies mainly to coaches and tank wagon maintenance facilities.

At present there are no shortages of rolling stock. The actual figures on numbers of rolling stock, their availability and the average daily requirements are given in the rolling stock part of this report There is generally a surplus of locomotives as well as of wagons and coaches. But if the critical maintenance situation will persist, shortages will arise within a short time. The first sector to be affected, will be the passenger coaches. Here the excess numbers are not as high as with locomotives and freight wagons.

Loop tracks of wayside stations and tracks in marshalling yards are often being used for stabling of excess rolling stock. At present, this fact doesn't have a negative effect on train

operations, because crossings of trains in wayside stations has decreased with lower traffic volumes and marshalling yards as well, are working below capacity.

## METHOD OF LINE CAPACITY CALCULATION ACCORDING TO UIC 405 R.

### Introduction

All future planning on the TDY network makes it necessary to establish universally recognised principles for assessment and development of the lines of the network.

One of these internationally recognised principles to be applied by TDY railways in assessing the lines is a harmonised method for determination of line capacity. The use of this method, explained in leaflet UIC 405 R, will provide the conditions necessary for establishing a picture of the capacity of a line section and identifying the necessary infrastructure to operate a train programme. Railways are advised to apply the method, particularly for calculating the capacity of lines.

### Principles of the method

The method has been developed with the following criteria:

- The method must be applicable for any railway. For this reason, the method chosen does not require data processing equipment.
- The method must be simple and applicable without incurring undue expenditure.
- The capacity determined by this method must take into account the parameters of all trains running on this line and the relative proportion of trains in the various categories.
- The method must also take into account the existing conditions of the line, such as the divisions into block sections and the type of signalling installations.

### Basic Definitions

**Capacity:** The capacity of a line expresses the number of trains which could possibly be operated in a certain time on each track, taking into account:

- certain operational and technical conditions,
- certain quality criteria to be observed.

The capacity is calculated based on the determinant sector of the line in in the section expressed in the number of trains per period.

**Line:** A line section runs between two stations where passing and/or crossing can be executed ( not generally next to each other), or junctions, in which there are no significant changes regarding:

- the number of trains (plus or minus 10%), and
- the relative proportion of the various train categories with different characteristics, like differing running speeds and different numbers of stops

A line section generally consists of several sectors.

**Determinat sector of line:** The determinant sector is the one which has the smallest capacity in the given line section.

**Calculation formula for single track sections**

The calculation of the capacity of a line section is based on data related to the determinant sector to which an additional term is added to take into account the characteristics of the line section and the quality of service.

The determinant sector of the line is generally the one with the longest operating times and where the average duration of minimum train headway times $t_m$ is the highest. All calculations refer t the front of the trains. The capacity of a line section is calculated with the following formula:

$$L = \frac{T}{t_m + t_r + t_{zu}}$$ ( Number of trains/reference period)

in which:

$L =$ capacity of a line section in numbers of trains

$T =$ reference period in minutes

$t_m =$ average duration of train headway time in minutes

$t_r =$ extra time margin in minutes to take into account the characteristics of the line section

$t_{zu} =$ additional time in minutes to take account of the quality of service on the line section (delays, total amount of waiting time, influence on other line sections)

In general, unless any other conditions are fixed, capacity is indicated as per day (T = 1440 minutes).

**Calculation formula for double track sections**

For double track sections, the following formula is applied:

$$N = \frac{T}{h * v' + (r + u + 1) * v} * f$$

in which

N = single way line capacity; needs to be calculated seperately for odd and even direction

h = time interval between consecutive trains with high running speeds

r = maximum time required between a slow train and a fast train

u = minimum time required between a fast train and a slow train

v = fast train ratio = $\frac{\text{number of fast trains}}{\text{total number of trains/direction}}$

v' = slow train ratio= $\frac{\text{number of slow trains}}{\text{total number of trains/direction}}$

f = performance allowance at 60%

# TDY STAFF NUMBERS

**MAIN ACTIVITY**

| Departments/Divisions/Sections/Depots | 01.01.1991 | 01.08.1997 | Changes (+ or -) at 01.08.97 |
|---|---|---|---|
| **Enterprise** | | | |
| Locomotive services – depots | | | |
| Ashgabat | 1382 | 770 | |
| Chardjow | 1302 | 1017 | |
| Mary | 824 | 676 | |
| Gazandjik | 812 | 618 | |
| TOTAL | 4320 | 3081 | |
| Wagon Services – depots | | | |
| Ashgabat | 386 | 289 | |
| Charjow | 821 | 910 | |
| Mary | 260 | 288 | |
| Turkmenbashi | 528 | 284 | |
| TOTAL | 1995 | 1771 | |
| Passenger Services – depot Ashgabat | 1551 | 1716 | |
| Signalling and Communications – track sections | | | |
| Ashgabat | 335 | 367 | |
| Amudarya | 103 | 176 | |
| Mary | 352 | 436 | |
| Charjow | 440 | 504 | |
| Krasnovodsk | 190 | 198 | |
| TOTAL | 1420 | 1681 | |
| Track Services: | | | |
| Track Services - sections | | | |
| Ashgabat | 522 | 679 | |
| Amudarya | 343 | 365 | |
| Charjow | 673 | 532 | |
| Darganata | 475 | 285 | |
| Mary | 407 | 313 | |
| Gushgy | 402 | 394 | |
| Buzmeyin | 314 | 434 | |
| Gazandjik | 275 | 225 | |
| Krasnovodsk | 347 | 241 | |
| Dashkhovuz | - | 200 | |
| Track services – machine stations | | | |
| Gyzylarbat | 153 | 205 | |
| Dashkhovuz | 324 | 194 | |
| Mary | 166 | 215 | |
| Track services – on-line workshops | | | |
| Chardjow | 58 | 50 | |
| Track services – rail welding train | | | |
| Chardjow | 57 | 48 | |

| | | | |
|---|---|---|---|
| Track services – tree protection-unit | | | |
| Farap | 250 | 313 | |
| TOTAL TRACK SERVICES | 4766 | 4693 | |
| Electricity supply services – sections | | | |
| Ashgabat | 193 | 183 | |
| Chardjow | 187 | 170 | |
| Mary | 79 | 102 | |
| TOTAL | 459 | 455 | |
| Operations service: Ashgabat Division | | | |
| Station - Ashgabat | 242 | 182 | |
| " Krasnovodsk | 231 | 208 | |
| " Mary | 200 | 179 | |
| Other locations | 2185 | 2103 | |
| TOTAL | 2858 | 2672 | |
| Chardjow Division | | | |
| Station Chardjow - 1 | 199 | 199 | |
| " Chardjow - 2 | 194 | 148 | |
| Other locations | 1312 | 1222 | |
| Loading-unloading section (did not exist in 1991) - for numbers see freight handling section Chardjow below | n/a | 192 | |
| TOTAL | 1705 | 1761 | |
| Freight handling - sections | | | |
| Chardjow (now part of the moving service - Chardjow division) | 260 | n/a | |
| Ashgabat (non-existent now) | 509 | n/a | |
| TOTAL | 769 | n/a | |
| Civil construction - sections | | | |
| Ashgabat | 391 | 304 | |
| Chardjow | 342 | 224 | |
| Mary | 167 | 98 | |
| Krasnovodsk | 193 | 140 | |
| TOTAL | 1093 | 766 | |
| Central Admin Office | 442 | 337 | |
| Other enterprises on the main activity | | | |
| Centralised Dispatch Unit (did not exist in 1991) | n/a | 72 | |
| Procurement & Supply Service | 142 | 132 | |
| Automatic Payroll & Calculations Unit Ashgabat | 40 | 69 | |
| TOTAL | 182 | 273 | |

| | | | |
|---|---|---|---|
| TOTAL ON THE MAIN ACTIVITY | 21560 | 19206 | - 2354 |

**OTHER ACTIVITIES**

| Ancillary activities | 01.01.1991 | 01.08.1997 | Changes (+ or -) at 01.08.97 |
|---|---|---|---|
| Institute "Turkmenzheldorproject" | 24 | 56 | |
| Energy train Enev | 56 | 56 | |
| State enterprise "Promzheldortrans" (provide maintenance to siding tracks of industrial enterprises - did not exist in 1991) | n/a | 339 | |
| Wagon repair works (VRZ) Gyzylarbat | 925 | 427 | |
| Firm "Turkmentransmost" | 250 | 17 | |
| Construction train (CMP) Ashgabat (1997 - merged with CMP3 Ashgabat) | 220 | 386 | |
| Construction train (CMP) 2 Chardjow (1997 - merged with CMP4 Chardjow) | 411 | 725 | |
| Construction train (CMP) 3 Ashgabat (does not exist in 1997 - merged with CMP Ashgabat) | 210 | n/a | |
| Construction train (CMP) 4 Chardjow (does not exist in 1997 - merged with CMP 2 Chardjow) | 174 | n/a | |
| Bridge brigade Ashgabat (formerly part of the firm "Turkmentransmost" - did not exist in 1991) | n/a | 162 | |
| Bridge brigade Chardjow (formerly part of the firm "Turkmentransmost" - did not exist in 1991)* | n/a | 199 | |
| TOTAL ON NON-TRANSPORT ACTIVITY | 2270 | 2367 | + 97 |
| * In September 1997 Bridge brigade Chardjow was merged with CMP Chardjow | | | |

| | | | |
|---|---|---|---|
| **TOTAL IN TDY** | **23830** | **21573** | **- 2257** |

## Dismissal Procedure

An employee should be given a notice of the proposed dismissal and sign the notification paper at least two months in advance.

When dismissal is caused by staff reduction, the privileges envisaged in the labour legislation regarding keeping the job are taken into account.

Simultaneously with giving the dismissal notification, the administration should offer the employee another job at the same enterprise. In case of unavailability of vacancies of the same specialty and also if the employee declines transfer to another job, he/she should seek assistance in employment from the employment agency or find a job himself. At the same time the administration informs the employment agency of the future dismissal of the employee with reference to his/her profession, specialty, qualifications and salary level.

The employment agency offers the employee another position in his/her specialty, level of qualification and preferably in the same region and if such a position is not available - another job with regard for personal desires and public demand.

Upon the employee's agreement, he/she may be retrained to a different profession with an arrangement for subsequent employment.

## Severance pay and privileges

The employees who get dismissed with termination of the labour agreement as a result of staff reduction:

1. Receive a single severance payment in the amount of their average monthly salary;
2. Continue receiving their average monthly salary during the period of employment but not longer than for two months counting from the date of dismissal and with regard for the dismissal pay;
3. As an exception, and only if the employee timely (within two weeks after the date of dismissal) applies to the employment agency and the agency does not find him another job, he/she may be paid his/her average monthly salary for the third month.

Dismissal pay and continued monthly payments are provided by the organization from which the employee is dismissed.

The above described employee is considered to have his/her "service term" uninterrupted if the gap between two jobs after the dismissal does not exceed three months.

According to the labour legislation, the pension age for men is 60, women - 55, women having 5 or more children - 50.

# Baseline Environmental Data

## 1. Current Environmental Situation in Turkmenistan

This section will briefly recall the main environmental features of Turkmenistan. At the time of the writing of the present report, the location of the critical railway sections to be rehabilitated within the restructuring process are not yet precisely located. Hence, only a general environmental profile of the country will be given. The main sources of information used were a World Bank report n°16142-TM on Water Supply and Sanitation Project (April 1997), and the Turkmenistan Human Development Report, UNDP 1996.

### 1.1. General Information

Turkmenistan is bordered to the west by the Caspian Sea, to the south by Iran and Afghanistan, to the east by Tajikistan and to the north and Northeast by Kazakhstan and Uzbekistan. The country covers 488,100 $km^2$ and spans 1,100 km from east to west ad 650 km from north to south.

The sand deserts of the Turan lowlands, the Central, Zaunguz and South-eastern Karakum deserts, make up 80 % of the country territory. In the south, the desert gives way to the foothills and mountains of the Kopet-Dag range and to the Paropamize mountains in the southeast. The right bank of the Amudarya is covered by the Sundukli sands. To the east of the Caspian Sea lies the Western-Turkmen seaside lowland, covered with saline soils and loosely fixed sands. In the extreme east, the Kugitangtai branch of the Gissar ridge extends into Turkmenistan.

The climate of the lowland territory is severe-continental and extremely dry. Average annual rainfall in Turkmenistan ranges from 76 mm on the Garabogazgol coast to 400 mm in the Kopet-Dag mountains.

Three main rivers provide surface water in Turkmenistan: the Amudarya, which supplies 90 % of the water of the whole country, and the Murgab and Tedgen rivers that have significantly smaller resources. These rivers originate in the mountains outside Turkmenistan. The remaining rivers have very low flow throughout the year. Within the country, water is further distributed by an extensive network of irrigation canals totalling more than 30,000 km in length. In particular, the Amudarya river is the source of water of the Karakum Canal - the largest hydrotechnical work in the world - for more than 1,100 km across the southern territory of Turkmenistan.

Groundwater resources cannot be fully utilised since most of the aquifers are relatively deep and remote from the main agricultural consumption areas. Hence, the amount of groundwater presently used is very low.

# TÜRKMENISTAN

Appendix 16