Tacis

TRACECA :

Rolling Stock Maintenance - Railways

TNREG9309

Completion Report

Country profiles, part ¾

July, 1997

ARMENIAN Railways

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1. Overall

1.1 Background

Due the de facto blockade of the country, and the break up of the Former Soviet Union, the traffic has dropped dramatically resulting in a very poor state of the rolling stock and the permanent way including signalling and communications.

As the railways are the only realistic transport mode for the most needed humanitarian aid to Armenia, the UN World Food Programme Organisation is assisting AR to some extent, but the assistance is meanwhile far from being large enough, and in a very short period of time it can be foreseen that the entire railway system will be brought to a standstill if no additional aid is allocated.

It should be noted that the Armenian Government decides the tariffs, but does not allocate any subsidies to the railways. It was reported that approximately 60% of the revenues were spent to purchase spare parts and consumable.

Due to the rather autonomous state of the railways certain passenger services have been closed down without any interference from the government.

1.2 Network and train operation

Being a land-locked country, Armenia heavily relies on neighbour countries to import and export goods outside the region.

The AR network consists of 845 km of single track (1520 mm gauge) except for the short Yerevan- Massis line which is fitted with double track.

All lines including side lines are electrified (3000 V DC) and the network serves 72 stations.

There are two main lines:

- Georgian border to the Naghitchevan enclave of Azerbaijan : Airum-Vanadzor-Gioumri-Oktembri-Massis-Yerash-Veldagh
- Massis-Yerevan-Abovian-Razdan-Vardeniz-Zod (a gold mine district) ; from Razdan, a branch line connects the main line to Azerbaijan network and from Gumri a branch line reaches the border of Turkey.

In addition three branch lines, totalling 210 km, feed major industrial sites :

- Gioumri-Maralik
- Oktembri-Arsaluis
- Massis-Karmirblur

In many parts of the country the curves are reduced to 150 m radius and the slopes reach 38 o/oo gradient on length up to 18 km.

Going down the slopes the regenerative braking of the electric locomotives feeds back the line. However, most of the lines are single track, therefore, the regenerative braking is not efficient since it cannot supply another locomotive going up.

The train operation is often downgraded due to lack of electric power in the catenary. Then, the number of trains with the minimum number of locomotives should be kept working on the defective area in order to allow this minimum train to run.

As the track is in poor condidtion, severe speed limits are enforced and in some areas the maximum speed is reduced to 15 km/h.

Max. speed : 74 km/h (it was formerly 100 km/h for passenger traffic and 80 km/h for freight trains).

Nos. of stations : 72

No. of tunnels and bridges : not disclosed.

The number of employees has dropped form 18,000 to 6,100 mainly due to a strict staff cuts policy, but also because many experts and skill workers have left the Railways to seek better salary.

1.3 Traffic

Due to the break-up from the former Soviet Union and the by the blockade of Armenia by neighbouring countries the goods traffic has dropped significantly and passenger traffic is less than half what it was during the last seven to eight years, as shown in the following table:

Year	Mill. tons km	Mill. tons	Mill. Passenger km
1988	4803		351
1989	5120		320
1990	4884	37.6	259
1991	4179	29.1	285
1992	1280	7.5	381
1993	450	2.6	142
1994	N/A	N/A	N/A
1995	402	N/A	166

In the future the drop in passenger traffic might be more pronounced as certain passenger lines are closed down due to lack of revenue.

2. Rolling stock

2.1 Locomotives

In total AR own 74 electric locomotives type VL 8 and VL 10 (4200 kW and 5500 kW) out of which 46 are in operation.

Most of the electric locomotives are 30 to 40 years old, the newest ones from 1972.

The diesel locomotive fleet consists of TEM 3 (1200 HP) and M-62 (4000 HP), totalling 75 locomotives, among of them 11 are in working condition.

The diesel locomotives are normally used as shunters.

The TEM 3 are from the 1960-ies while the youngest M-62 are from 1988.

All of the locomotives are more than 10 years overdue for capital repair and the locomotives waiting for repairs need a comprehensive rehabilitation as many of them have been cannibalised.

2.2 EMUs

The Electric Motor Unit fleet, built in the Baltic states, consists of 89 vehicles, among them 28 are in operation.

2.3 Coaches

AR have 298 coaches of various types, among them 134 are in traffic.

Approximately 100 coaches need a capital repair and 64 vehicles need a depot repair.

2.4 Freight Wagons

The total number of wagons is 4,835, but only 1,250 wagons are presently in operation.

3. Maintenance of the rolling stock

The total number of employees for the maintenance of the rolling stock is 1,157 including drivers and driver assistants.

AR are still trying to follow the FSU standards and procedures for running maintenance, but the lack of spare parts and consumable is a very serious constraint.

Capital repairs, previously carried out outside Armenia, are no longer done due to the blockade.

AR are keen to keep the vehicles in traffic by repairing the most pressing items, but again lack of spares makes these efforts more and more difficult.

Some of the spare parts are manufactured in Armenia, but are often of poor quality. Anyhow, the low railway revenues do not allow them to purchase the required spare parts, even on the domestic market.

According to the information obtained, the yearly costs of maintenance are USD 516,000, but even though the average monthly salary is USD 20, the maintenance costs seem to be highly underestimated.

Getting spare parts by cannibalising out of service vehicles is almost exhausted, thus in a short time the entire fleet will be in a standstill.

3.1 Maintenance facilities

The maintenance of the AR rolling stock is located in two districts, Yerevan and Gioumri:

- Yerevan depots :
  - electrical and diesel locomotives, EMUs
  - passenger coaches and freight wagons
- Gioumri depots:
  - electrical and diesel locomotives, EMUs
  - freight wagons

3.1.1 YEREVAN depots

3.1.1.1 Coach and Wagon Depot

As the freight wagon depot was ruined by the 1988 earthquake, both wagons and coaches are maintained in the same depot, built in 1978.

The capacity of the depot is designed to maintain 300 wagons and 200 coaches per year, but practically all of the machinery need to be renewed.

One of the newest machines, the Polish wheel lathe (Rafamet) is from 1983, and will soon need a major overhaul.

Taking into consideration that lack of spare parts which is a serious constraint, the wagons look rather good whereas the passenger coaches are in a pitiful shape.

Windows are missing and the heating system is out of order making it a terrible experience to travel by train in winter time.

The brake blocks, manufactured locally, were said to be too soft therefore their lifetime is very short.

Rolling bearings are dismantled according to maintenance rules, but no measurements are taken, and after cleaning and greasing the bearings are re-mounted on the wheels.

3.1.1.2 Locomotive Depot

The depot has three tracks for the maintenance of locomotives :

- EMU
- Diesel
- Electrical

The depot is very spoiled with motors and other heavy components dumped in the pits.

Waste oil was evident all over the floors and in the pits.

Meanwhile the work stations are well designed, fitted with lowered gangways along the tracks for better access to the undercarriage of the vehicles.

The workshops for the repair of speed-o-meters and recorders and the test bench for the brake system are in good working order and looked neat and tidy. But only little work is carried out in the workshops.

To re-profile the wheels, a Polish under floor wheel lathe had been installed in 1986 and is in working condition.

In order to recover the correct thickness of the wheel flanges, additional metal is welded. The method is developed in Russia, and was claimed to have been used for many years, but in western Europe it is considered as dangerous. Welding can easily be dis-integrated from the flange causing a serious accident.

However, since the operation speeds are low, it could be expected little consequences if accidents occure. Therefore, it is a cheap way for prolonging the lifetime of the wheels.

3.1.2 GIOUMRI depots

3.1.2.1 Freight Wagon Depot

The wagon depot is under construction and expected to be in operation in 1996.

In the wagon shop there are two tracks, the length of each of them allow to accommodate four to five wagons depending on their type.

Lifting gear and gantry crane have been installed, but the floor needed to be covered by a smooth layer of concrete.

The bogie and wheel shops are allocated next to the wagon shop which ensures short transport lines.

Provisions were made for bogie cleaning machine, but the equipment are not yet installed.

A new Ukraine wheel lathe has been installed, but is not yet tested.

In addition the following workshops are almost ready for operation :

- Repair of automatic couplers
- Maintenance of brake systems
- Tool shop
- Repair of doors, panels, hatches etc.

Ventilation is not installed in the workshops, which will create problems when welding will be done.

The wagon depot was design to maintain 3,000 wagons per year, but due to the current needs, only 1,000 wagons will be maintained in the depot.

Number of employees: 40.

3.1.2.2 Old locomotive depot

The old locomotive depot was built in 1953, but was damaged during the earthquake in 1988 to an extent that the building is in danger of a total collapse.

Measures have been taken to secure the building, but so far actual repairs of the cracked walls have not taken place.

In the main shop there are three tracks with pits.

Components are scattered all over the place and even in parts of the pits motors are dumped.

The floors are covered with a thick layer of waste oil.

At one of the pits an under floor wheel lathe is positioned to profile the wheels.

In connection with the main locomotive shop the following workshops are laid :

- Electrical shop for re-winding of anchors and stators including varnish insulation and test of the finished motors.
- The shop looks well organised and many motors were under repair, but it is difficult to obtain the right varnish for insulation, and the technicians are testing alternative products produced in Armenia.
- Machine shop where all machines are in working condition, but very old.
- Workshop for compressors.
- Workshop for brake systems.
- Workshop for switch gear.

All of the above mentioned shops were nice and tidy and most of the equipment are in operation.

In a special workshop a new Russian welding equipment has recently been installed enabling welding of wheel flanges.

3.1.2.3 New Locomotive Depot

The new locomotive depot in Gioumri is not in the same state of completion as the new wagon depot, but the staff expected the depot to be in operation before the end of 1996.

It is a rather large depot with tracks for 15 diesel and 10 electric locomotives and in an additional shop there are two tracks for 12 EMU vehicles.

It is planned that 10 to 15 capital repairs of mainline locomotives will be carried out per year, but the capacity of the new depot is probably around 100 capital repairs per year.

3.2 Summary of existing maintenance facilities

Depots for running maintenance	Year of construct / improvt	Number of bays	Capacity TR / year	Comments
Yerevan locomotive depot		6		Required comprehensive overhaul
wagon depot		300 wag 200 coach		Required comprehensive overhaul
Gioumri old locomotive depot				building collapse threaten Specialised shops : working
new locomotive depot		25 loco 12 EMU		Under construction
wagon depot	1996		3,000	commisioned in 1996

4. Future requirement evaluation

4.1 Assumptions

4.1.1 Traffic forecast for the next 10 years

Freight traffic

Average distance run by freight is assumed to remain constant between 1993 and 1995. Total of freight transported in 1995 has been calculated from freight turn around and an average distance of 180 km.

There is no transit traffic in Armenia.

Quantities of import and export goods are not available.

Passenger traffic

From passenger turnover, the annual ridership has been evaluated taking into account an average trip length of 180 km, similar as average freight distance run.

Summary of traffic estimates

year		1995	%	2000	2005
Passenger turnover	**th pass.km**	**166,000**		**166,000**	**166,000**
Total ridership	**th pass**	**976**		**976**	**976**
Freight turnover	**th t.km**	**402,000**		**402,000**	**442,000**
Total freight	**th t**	**2,233**		**2,233**	**2,456**
Imported by rail	th t				
Exported by rail	th t				
Domestic traffic	th t				

4.1.2 Evaluation of operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	8	8	14	14	18
Annual average distance run	km	12,910	44,981	145,459	144,534	307,750
Freight trains						
Average speed	km/h	15	15	30	30	40
Average train load	t	2,000	2,000	2,000	2,000	2,000
Average wagon load	t	50	50	50	50	50
Wagon turn around	days	12	12	12	10	6
Annual distance run per wagon	km	3,326	12,000	12,000	14,400	24,000
Passenger trains						
Average speed	km/h	25	25	40	40	80
Average train ridership	pass	300	300	200	200	200
Average coach per train		10	10	8	8	5
Annual distance run per coach	km	18,568	46,957	75,130	75,130	150,261

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	74	21	8	9	4
Freight trains		12	3	4	2
Passenger trains		10	5	5	2
Shunting locomotives	75	10	10	10	10
Passenger coaches	298	118	88	88	28
Wagons - total	4,835	1,340	1,340	1,228	737

4.3 Maintenance facilities requirements

4.3.1 Locomotive maintenance facilities

Main line locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of electric main line locomotives	148	42	17	18	4
Annual run of a locomotive km	12,910	44,981	145,459	144,534	307,750
Running inspection					
Production of TO3 / TR1	2,960	850	339	352	12
Production of TR2	148	42	17	18	4
Production of TR3	74	21	8	9	
Overhaul					
Production of KR	11	3	1	1	

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	75	10	25	10	10
Running inspection					
Production of TO3 / TR1	750	100	250	100	20
Production of TR2	30	4	10	4	3
Production of TR3	19	3	6	3	2
Overhaul					
Production of KR	11	1	4	1	2

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
umber of passenger coaches to be maintained	298	118	88	88	28
nnual run of a passenger coach km	18,568	46,957	75,130	75,130	150,261
unning inspection					
Production of TO2	298	118	88	88	28
Production of TO3	298	118	88	88	
Overhaul					
Production of KR	60	24	18	18	6

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
umber of wagons to be maintained	4,835	1,340	1,340	1,228	737
nnual run of a wagon km	3,326	12,000	12,000	14,400	24,000
unning inspection					
roduction of TR	4,835	1,340	1,340	1,228	737
Overhaul					
Production of KR	484	134	134	123	74

5. Recommendations

5.1 Management

It is recommended to organise each depot and workshop in business unit as described in the Part 2 Chapter 3 of this report.

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level. Due to the numerous depots and workshops distributed all over the country, a special care has to be borne in the implementation of a centralised information system which will collect data in each of the depots and workshops M. I. S.

USD 1 millions have to be allocated for consulting services, logistics and computers.

5.2 Rolling stock

To deal with the current situation, 41 locomotives are required : 21 main line electric and 10 shunting.

50 are available : 40 main line electric and 10 shunting.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 20.

The locomotives are old and they will have to be replaced soon. However, it is not recommended to buy new locomotives as long as infrastructures deficiencies (track conditions and power supply availability) will not have been solved. Second hand diesel locomotives could be acquired in Central Asian countries or electric locomotives could be shared with Georgia.

USD 500,000 millions have to be allocated to each of the 20 locomotives to be renewed.

For the time being, all the passenger coach available fleet is required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are in very poor condition. Even though new types of passenger coaches will appear is the next years, the existing ones will be needed during at least 10 to 15 years for long distance services. Comprehensive rehabilitation and modifications have to be carried out in those existing ones.

USD 150,000 have to be allocated to each of the 120 coaches during the 10 next years.

The fleet of existing wagons (4,800) is large enough to cover the current needs (1,300). However, rehabilitation is required on most of them.

USD 10,000 have to be allocated to each of the 1,300 for comprehensive overhaul.

5.3 Maintenance facilities

The 5 depots are not necessary to maintain the 35 locomotives (25 main line and 10 shunting), the 120 passenger coaches and the 1,300 wagons required to deal with the current situation. Therefore, it is recommended to improve the conditions of some of them and to close down the other ones.

It is proposed to keep working the new Gioumri depots which are large enough to cope with the required fleets.

The depots are new, hawever, new machinery are needed and overhauls of the working ones are also required.

USD 3 millions have to be allocated to the improvement of machinery and tooling

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph will include a relevant spare parts management system. However, the railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 3 millions have to be allocated to the urgent needs of spare parts.

5.5 Investment plan for the next 10 years

Investment - USD million	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	3	
Restructuring - M I S system	1	
Locomotives	5	5
Passenger coaches	9	9
Wagons	6	7
Maintenance facilities	3	
Total	27	21

AZERBAIJAN Railways

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1. Overall

1.1. Background

The Azerbaijan Railways (AZhD) started operating in 1883, and the first line was electrified in 1926.

Since the break-up of the Former Soviet Union the passenger and freight traffics have dropped strongly which has been further increased by the unrest in the Caucasus region.

Apart from the line to Georgia, all other lines to the neighbouring countries have been closed.

Moreover, very little funds are allocated to the maintenance of the rolling stock, and practically no foreign currency is available for the purchase of spare parts and components.

Therefore, the AZhD fleet of vehicles is in a very poor state and the entire operation is about to be brought to a complete standstill.

1.2. Railway network

The total length of the main track lines is 2,125 km of which 806 km are double tracks, and approximately 1,280 km or 60% of them are electrified (3.3 kV DC).

1,126 km of the line have an auto-lock safety system, 450 km have a semi-auto-lock.

Network characteristics

- Track gauge : Russian standard gauge of 1,520 mm.
- Total number of stations : 177 including two marshalling stations.
- Average distance between stations : 12 km
- Max. slope : 25 o/oo length 13.9 km
- Number of tunnels : 15 (total length: 3,829 m)
- Number of bridges : 2,094
  - 35 bridges > 100 m long
  - 182 bridges 25 to 100 m long
  - 1677 bridges < 25 m long

Speed limits of 40, 25, and 15 km/h are now introduced due to the poor condition of the tracks.

1.3. Railway organisation

The present Railway Organisation consists of :

- 15 railway departments
- 5 locomotive depots
- 5 wagon depots
- 2 coach depots
- 9 signal divisions
- 6 power supply divisions
- 5 civil engineering divisions

- 3 loading/unloading divisions
- 3 permanent way repair machine stations
- 1 computer centre.

In addition AZhD Railways is managing industrial enterprises, trading centres, a railway college, a technical school, primary and secondary schools and kindergartens.

The industrial sites consist of :

- Concrete slabs factory
- Cement brick factory
- Three quarries
- Track welding site
- Baku Tank Wagon Repair Plant

Since Independence some 150 Armenian and 200 Russian railway specialists have left Azerbaijan.

As aforementioned the present number of employees is more than 48,000 people, but a major re-organisation including a comprehensive staff cuts policy is going to be enforced in the near future.

1.4. Freight and passenger traffics

The salient figures for the years 1989 to the first five months of 1996 are shown in the following table :

YEAR	TON KM	% of 1989	PASS.KM	% of 1989
1989	41,895,200	100 %	2,022,100	100 %
1990	37,076,000	88 %	1,827,200	90 %
1991	30,479,000	73 %	1,973,000	97 %
1992	13,782,000	33 %	1,625,800	80 %
1993	7,301,400	17 %	1,329,000	66 %
1994 *)	3,019,800	7 %	1,141,000	56 %
1995	2,245,900	5 %	791,400	39 %
1996 **)	1,058,200	2.5 %	216,200	11 %

*) 11 months

**) 5 months

Freight tonnage for 1996 were stated as follows

Internal	8,000,000
Transit	1,700,000
Import	465,000
Export	512,000
TOTAL	10,667,000

Among the transit, 200,000 are TRACECA (60,000t cotton, balance grain & food)

Transit times across Azerbaijan have been cut from 16h to 12.5h.

Average daily oil traffic is 19,000t.

An additional 5,000t traffic per day is planned due to the Chevron contract to transport Kazakhstan oil shipped to Baku. The oil would be transported to both Azerbaijan refineries (120 km), and Batumi.

7m tonnes of oil were transported in 1996 : 90% for domestic purposes and 10% for export. No growth is foreseen in 1997 or later.

2. Rolling stock

2.1. Electric locomotives

AZhD owns 152 electric mainline locomotives, powered by 3,000 V dc.

TYPE	TOTAL NOS.	NOS. IN OPERATION	NOS. SICKLINE	NOS. OLDER THAN 30 YEARS
VL 8	207	115	92	160
VL 11	43	35	8	2
VL 22	1	0	1	1
VL 23	2	2	0	2
TOTAL	253	152	101	165

2.2. Diesel locomotives

TYPE	TOTAL NOS.	NOS. IN OPERATION	NOS. SICKLINED	AGE (years)
TE 10	42	11	31	23 - 31
TE 3	22	12	10	7
M 62	24	7	17	7
TEM 2	128	91	37	9 - 31
CHME 3	50	20	30	10- 15
TEM 1	1	1	-	28
TOTAL	**279**	**147**	**132**	

2.3. EMUs

TYPE	TOTAL NOS.	NOS. IN OPERATION	NOS. SICKLINED	AGE (years)
ER 2	74	44	30	11 - 26
CR 3	1	1	-	36
TOTAL	75	45	30	

2.4. Passenger coaches

Total nos. of passengers coaches : approximately 800

Total nos. of coaches in operation : approximately 350

Average age is reported to be 10 to 15 years.

2.5. Freight wagons

Type	Total	Required repairs	% available
Closed	6453	3120	52 %
Platforms	4942	2865	42 %
Opened wagons	5860	1026	83 %
Tank wagons	4948	1269	74 %
Refrigerator wagons	2280	200	91 %
Hoppers	1285	0	100 %
Others	8543	1323	85%
TOTAL	**34 313**	**9803**	**71 %**

Age distribution of wagons was not disclosed.

Among the 8543 « others », 1500 are private wagons.

Among the 4948 « tank wagons », 480 are 120t 8 axle wagons.

3. Maintenance

3.1. Maintenance procedures

AZhD claims it still follows the maintenance rules as laid down in the Former Soviet Union.

The only exception is that AZhD has stopped the TR3 for some of the locomotives due to lack of spare parts and the overhauls of the locomotives and passenger coaches due to lack of foreign currency since overhauls have to be carried out abroad.

3.2. Maintenance facilities

3.2.1. Locomotives

3.2.1.1. Summary of locomotive maintenance facilities

Locomotives Depots for running maintenance	Year of construct improvt	Capacity	No of employees	Comments
Baku	1939		4113	Diesel and electric locomotives and EMU
Ganja				
Jalfa				
Imishli				
Balajari				
Salyan				

3.2.1.2. Baku locomotive depot

The depot is located at 20 km from Baku. It was erected in 1989.

Only TR2 preventive maintenance is carried out at present due to lack of spare parts.

An agreement was made with a Russian plant to do the capital repairs, but no maintenance was contracted due to lack of funds.

Staffing

The following number and category of staff is presently employed at the locomotive depot:

Profession	Planned	Existing
Engineers and Technicians	326	319
Locomotive Drivers	1,280	1,580
Assistant Locomotive Drivers	1,034	1,038
Fitters	744	586
Semi- and unskilled Workers	654	605
TOTAL	**4,038**	**4,113**

Diesel locomotive shop

Most of the lathes and other machine tools were introduced in 60-ties and only few of them are in working condition.

Electric locomotive shop

In the electric locomotive shop the three tracks are fitted with lifting jacks.

An old under floor wheel lathe (UF) is installed, but it is to be replaced with a new Polish one from 1989 which is still in its original shipping box.

It was not disclosed why the Polish machine has not been installed, but the reason is most likely lack of foreign assistance for installation.

The load test bench (Rheostat) for locomotives is out of order.

EMU depot

In order to lengthen the lifetime of the pantographs, short pieces of carbon are installed, avoiding replacement of the complete worn out pieces. It was pointed out that tracks and catenary are not properly aligned since out that the catenary makes contact with the pantograph outside the carbon area.

A number of lathes and other equipment from the 1950-ties are laid out in the depot, but only a couple of the machines are in working condition.

A new Polish wheel lathe (Rafamet) was installed in 1990, but it is out of order. The equipment is more sophisticated than the older ones and will most probably need a specialist from the manufacturer to repair it.

The electrical motor shop is only capable of doing maintenance at the outside of the motors i.e. commutations. The varnish shop insulating the motors is in working condition but no varnish is available.

3.2.2. Freight wagons

Wagons Depots for running maintenance	**Year of construct improvt**	**Capacity TR / year**	**No. of employees**	**Comments**
Shirvan	1996		220	New
Balajari	1934/65	4,500	320	To be rehabilitated - Tank wagons
Ganja	1978	4,500	500	Fair - Covered wagons
Aliat	1982	100	1,200	Fair - Refrigerator wagons
Kazi-Magomed	1968	1,600	280	Rehabilitation in progress - Opened and hopper wagons

Workshop for overhaul maintenance : KR	Year of construct improvt	Capacity KR / year		Comments
Baku	1920	2,800	600	Tank wagons

3.2.3. Passenger coaches

Passenger coaches Depots for running maintenance	**Year of construct improvt**	**Capacity DR / year**	**No. of employees**	**Comments**
Baku	1930	360	390	Required maintenance

The main coach shop can accommodate 4 coaches which can be lifted.

The lay-out of the wheel shop is fine.

Two polish wheel lathes are installed the youngest one, in 1987. All wheel lathes in the depots and plants require a major overall.

The brake shop can repair and tune up all brake valves. The equipment seems to be in good working order.

The lifting jacks are very old and do not look very safe.

The welding gear is from the 1960-ies and isolation is missing in several points of welding cables.

The electrical shop can carry out repairs such as commutator turning and mica isolator cutting, but there are no facilities for motor winding or test benches for motors and generators.

The shock absorbers are tested by a good working equipment. Measurement diagrams can be printed out.

A reasonable well equipped carpentry shop is standing idle.

Running maintenance of the coaches is carried out at an open-air track with pits.

4. Future requirement evaluation

4.1. Traffic forecast for the next 10 years

The freight traffic estimates are based on :

- the quantity of cargo transported in 1995 is estimated to be 9 millions tons
- the freight turnover is 2.246bn ton.km
- import and export by rail : 1.695 millions tons, among them 60% are minerals products (cf « TRACECA regional traffic forecasting model » project) ;
- an estimate average running distance of freight of 250km, due to the short distance covered by the 80% of domestic freight

The passenger traffic estimates are based on:

- the number of passengers transported in 1995 is estimated to be 5.2 millions.
- the passenger turnover is 790 mln pass.km
- an average distance covered by passenger of 150km

Summary of traffic estimate

year	1995	%	2000	2005
Passenger turnover th pass.km	791,400		791,400	791,400
Total ridership th pass	5,276		5,276	5,276
Freight turnover th t.km (excl. transit)	2,245,000		2,245,000	2,470,000
Total freight th t	10,667	100%	10,667	11,733
Imported by rail th t	465	4%	465	511
Exported by rail th t	512	5%	512	563
Domestic traffic th t	8,000	75%	8,000	8,800
Transit traffic th t	1,700	16%	1,700	1,870

4.2. Operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	8	8	14	14	18
Annual average distance run	km	30,476	88,118	212,722	210,925	342,190
Freight trains						
Average speed	km/h	35	35	40	40	45
Average train load	t	3,000	3,000	3,000	3,000	3,000
Average wagon load	t	60	60	60	60	50
Wagon turn around	days	10	10	5	5	4
Annual distance run per wagon	km	2,182	14,400	28,800	28,800	36,000
Passenger trains						
Average speed	km/h	40	40	60	60	80
Average train ridership	pass	250	250	200	200	180
Average coach per train		10	10	8	8	6
Annual distance run per coach	km	36,178	75,130	112,696	112,696	150,261

4.3. Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	153	53	26	27	18
Freight trains		19	9	10	7
Passenger trains		34	16	16	11
Shunting locomotives	229	100	80	80	50
Passenger coaches	875	400	281	281	176
Wagons - total	34,313	5,199	2,599	2,859	2,745
Open - PV	5,860	888	444	488	469
Tank - TS	4,948	750	375	412	396
Covered - KR	6,453	978	489	538	516
Refrigerator - XX	2,280	345	173	190	182
Platform - PL	4,942	749	374	412	395
Others	9,830	1,489	745	819	786

4.4. Maintenance facilities

4.4.1. Locomotive maintenance facilities

Main line locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of electric main line locomotives	303	105	51	53	18
Annual run of a locomotive km	30,476	88,118	212,722	210,925	342,190
Running inspection					
Production of TO3 / TR1	6,060	2,096	1,016	1,052	53
Production of TR2	303	105	51	53	18
Production of TR3	152	52	25	26	
Overhaul					
Production of KR	23	8	4	4	2

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	229	100	80	80	50
Running inspection					
Production of TO3 / TR1	2 290	1 000	800	800	100
Production of TR2	92	40	32	32	17
Production of TR3	57	25	20	20	8
Overhaul					
Production of KR	32	14	11	11	8

4.4.2. Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	875	421	281	281	176
Annual run of a passenger coach km	36,178	75,130	112,696	112,696	150,261
Running inspection					
Production of TO2	875	421	281	281	176
Production of TO3	875	421	281	281	
Overhaul					
Production of KR	175	84	56	56	35

4.4.3. Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	34,313	5,199	2,599	2,859	2,745
Annual run of a wagon km	2,182	14,400	28,800	28,800	36,000
Running inspection					
Production of TR	34,313	5,199	2,599	2,859	2,745
Overhaul					
Production of KR	3,431	520	260	286	274

5. Recommendations

5.1. Management

It is recommended to set up a central maintenance management as described in the Part 2 Chapter 3 of this report. The line inspection and the drivers (first level) have to be managed by the train operation department

This central management will define the maintenance rules, the equipment upgrading and procurement and will be in charge of co-ordinating resource sharing between depots and workshops.

Special attention has to be paid to maintenance monitoring and failure follow up.

Each depot and workshop will be organised in business unit.

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level. It will ensure satisfactory maintenance and spare parts management - see Part 2 Chapter 3 of this report -

USD 3 millions are to be allocated for consulting services, logistics and computers.

5.2. Rolling stock

5.2.1. Locomotives

To deal with the current situation 155 locomotives are required : 55 main line and 100 shunting.

479 are available : 240 main line and 179 shunting.

Most of the 152 electric locomotives are more than 30 years old, but 42 diesel locomotives are between 20 and 30 years old. Most of the shunting locomotives are not very ofd.

Improvements of train operation performances could allow to reduce even more the fleet to 26.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 18 .

The fleet of rolling stock is enough to cover the needs for the next 10 years if the relevant maintenance is performed.

The electric will have to be replaced in the next future, however, the diesel locomotives can cover the present needs. Moreover, it is recommended to improve operation performances and to implement a new maintenance management as described here above prior to introduce locomotives from a new generation. In any cases it is not recommended to purchase new locomotives from the existing ones.

For the time being, relevant maintenance has to be carried out on the required fleet. If nothing is done urgently the operation of all of the locomotives is likely to be in a standstill in the next 2 or 3 years. Original spare parts have to replaced the worn ones and overhauls have to be performed.

5.2.2. Passenger coaches

For the time being, 400 of the 800 passenger coaches are required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches will appear is the next years, the existing ones will be needed during at least 10 to 15 years for long distance services.

Inter-city trains are likely to replace, most of the long distance coaches, therefore, it is proposed to rehabilitate 50 % of the current operated fleet.

USD 50,000 have to be allocated to each of the 200 coaches during the 10 next years.

5.2.3. Wagons

The fleet of existing wagons (34,000) is large enough to cover the current needs (5,200). Improvements of operation performances will allow to reduce such needs to 2,700.

However, the tank wagons are rapidly deteriorating and the current fleet will have to be increased within 5 to 10 years. The study of a new wagon workshop is in progress - see the « Baku's tank workshop case study » in Part 4 of this report.

USD 20,000 have to be allocated for refurbishment of each of 1,000 wagons or procurement of new ones

5.3. Maintenance facilities

Since a small part of the existing rolling stock is required to cope with the current and forecast traffic, it is recommended to close some of the depots in order to increase the efficiency of the remaining ones. The following depots are proposed to remain working :

- 3 of the 5 locomotive depots
- 3 of the 5 wagon depots :
  - Ahiat for refrigerator wagon
  - Shirvan
  - Ganja
- the existing depot for passenger coaches

USD 1 million have to be allocated for adaptation to the restructuring requirements of each of those depots.

The Baku's locomotive depot has to be rehabilitated : replacement of old machinery, overhaul and repair of the best ones, cleaning, improvement of paths, procurement of motorised lift truck, fork lift.

USD 5 millions have to be allocated for the depot rehabilitation.

The Baku's tank wagon workshop should be rehabilitated.

USD 15 millions have to be allocated for it

Moreover, it is recommended to negotiate maintenance contracts with neighbouring countries for overhaul of locomotives and passenger coaches. The Baku's workshop will be able to perform overhaul of all kinds of wagons for the Azerbaijan fleet and neighbours' fleet.

5.4. Spare parts procurement

The management restructuring described in the preceding paragraph includes an efficient spare parts management system. However, it needs several years to be implemented and the railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 8 millions have to be allocated to the urgent needs of spare parts.

5.5. Investment plan for the next 10 years

Investment USD millions	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	8	
Restructuring - M I S system	3	
Locomotives	-	-
Passenger coaches	5	5
Wagons	10	10
Maintenance facilities	26	
Total	52	15

ANNEX 1 Required Spare Parts for Diesel Locomotives

Type	Amount	Price per Unit in USD	Total Cost in USD
Battery	100 sets	2,549.00	254,900
Battery	100	2,549.00	254,900
Main Inserts D 100	200 pieces	89.23	17,846
Inserts connecting rods	210 pieces	88.23	18,528
Inserts connecting rods	250 pieces	88.23	22,058
Main inserts	250 pieces	88.23	22,058
Motor axle bearings	30 pairs	269.00	8,070
Sprayers	100 pieces	49.01	4,901
Nozzles	100 pieces	88.23	8,823
Plunger's pair	100 pieces	39.20	3,920
Fuel pump	50 pieces	49.01	2,451
Nozzle	40 pieces	88.23	3,529
Sprayers	200 pieces	49.01	9,802
Locomotive Break blocks	10000 pieces	9.80	98,000
Electro-brushes	20000 pieces	3.60	72,000
Electro-brushes	11000 pieces	2.13	23,430
Total USD			825,216

ANNEX 2 Required Spare Parts for Electrical Locomotives

Type	Amount	Unit Price in USD	Total Cost in USD
Electrobrushes	2500 pieces	1.90	4,750
Electrobrushes	1000 pieces	4.76	4,760
Electrobrushes	1000 pieces	0.95	950
Electrobrushes	1000 pieces	0.85	850
Electrobrushes	2400 pieces	2.75	6,600
Angle insert	1600 kg	3.43	5,488
Cone pipes	1500 pieces	10.39	15,585
Exhaust chamber	200 pieces	82.35	16,470
Carriage Pantograph	60 pieces	32.94	1,976
Carriage Base Pantograph	20 pieces	4.90	98
Contactor	15 pieces	258.80	3,882
Contactor	15 pieces	258.80	3,882
Contactor	18 pieces	258.80	4,658
Contactor	18 pieces	258.80	4,658
Exhaust	25 pieces	82.35	2,060
Insert motoraxle hearing	20 sets	298.03	5,961
Total			82,628

ANNEX 3 Required Spare Parts for Tank Wagons

Spare Parts	
Friction instrument	150 pieces
Feed-shaft of the fraction yoke	100 pieces
Spare reservoirs	100 pieces
Breathing valve	200 pieces
Bolts in assembling	100 pieces
Bolts (different dimensions)	500 pieces
Plugs for lower damping device	3000 sets
Rollers for the cramp of the lower damping device	500 kg
Screws of the damping device	2000 pieces
Split (different dimensions)	1000 pieces
Washers for the plugs of the damping device	1500 pieces
End-line - cockvalve	1000 kg
Inspection covers for axle-box	1000 pieces
Traction yoke	500 pieces
Turner	1000 pieces
Upper-spring beam	100 pieces

ANNEX 4 Required Spare Parts for Capital Repair of Tank Wagons

Spare Parts	
Low grade steel	30 tons
Medium grade steel	40 tons
High grade steel	50 tons
Iron bars	15 tons
Cron roller	1.0 tons
Paint: Black, white, blue, red	5.0 tons
Electrodes for hot-welding	5600 tons
Grease for roller bearings	10 tons
Pipes, others	3.0 tons
Timber for wagon building	10.000 cub.meters
Cutting tools for wheels	2000 pieces

GEORGIA Railways

Table of contents

1. Overall

1.1 General description of the network

The railways in Georgia are laid to the standard Russian gauge of 1520 mm and rails are set at 1 in 20 inclination. A mixture of concrete and timber sleepers are used with heavy section flat bottom rail. On the main line 25 tonne axle loads are accepted but on other lines the limit is 23 tonne.

Total route length is 1600 km and this includes approximately 255 km in the Abkhazetia region. From the border with this region to the main line at Senaki is about 39 km.

The Main Line is considered to extend from Senaki (2232 km from Moscow) to the Azerbaijan border; 278 km to Tbilisi Junction plus a further 42 km from the junction to Gardabani and the border. A total of 268 km of this is double track but there are presently some 40+ km in the Zestafoni to Khashuri section which are worked as single track due to river erosion of the track embankments. Work is in progress to restore this section to double track throughout.

There are two important lines connecting Black Sea ports to the main line. From Poti to Senaki is a distance of 41 km, and from Batumi to Samtredia is 106 km. The only other line of importance is from Tbilisi Junction (2510 km from Moscow) to the border with Armenia of 69 km. The three lines described herein are single throughout.

Some fourteen other country branch lines contribute approximately 775 km and the balance of distance is made up of triangulation of the junctions at Tbilisi, Khashuri and Samtredia.

On the whole network there are some 158 stations giving an average distance of just over 10 km between each. There are 34 stations on the main line, 3 on the Poti line, 10 on the Batumi line and 4 on the line to Armenia.

Maximum speeds, which used to be 100 km/hr for passenger and 80 km/hr for freight, are now limited to 60 km/hr and 40 km/hr respectively.

The section from Zestafoni to Khashuri is the most arduous on the network the line rising nearly 2000 m in just over 60 km. Ruling grades are as steep as 1 in 36 (2.8%) and, whereas trains of 3,500 tonne can be operated from Batumi and Poti to Zestafoni by a single locomotive, they are limited to 2,500 tonne on the Zestafoni to Khashuri section with three locomotives. In addition to the grades there are torturous curves with many radii as tight as 150 m.

There are seven tunnels on the main line, the three longest being 740 m between Dzirula and Kharagauli and 3998 m between Tsipa and Likhi (both in the Zestafoni to Khashuri section) and one of 1026 m near Mtskheta, some 20 km west of Tbilisi. The other four average 140m in length. There are also two tunnels on the Batumi line, the longest being 272 m and the other 102 m.

On the main line and the three other principal lines there are 472 bridges and 2 viaducts, twenty seven of the bridges being of steel construction. All other bridges are of stone or concrete construction. Considering bridges of over 75 m in length, there are 30 on the main line (including the two viaducts) of which 8 are of steel, 2 on the Poti line both of which are steel, 6 on the Batumi line including three of steel and 2 on the line to Armenia of which one is of steel construction.

The longest bridge is No. 1 on the Poti branch which is a steel bridge of 473 m. Other long bridges are No 151 on the Batumi line, 268 m (steel) and Nos. 33, 142 and 173 on the main line (208 m, 219 m and 208 m respectively).

1.2 Condition of the infrastructures

The trackwork is in poor condition mostly due to a huge backlog of sleepers.

Locomotive sanding is used for assistance with adhesion and this is required when starting eastbound trains in the heavily graded section. Quartz sand is quarried from the mountains, washed graded and dried for use in the locomotives. In view of its use in the Zestafoni to Khashuri section it may be worth examining the tracked conditions in this area as continued use of sand may have caused sufficient contamination of the ballast to prevent adequate drainage which in turn could lead to misalignments.

Although tests have been carried out with five locomotives coupled in multiple, normal working is limited to three units for bridge durability. Twenty seven bridges are damaged and currently have severe speed restrictions imposed.

The condition of the track is not only a limitation in train operation performances, but also a major cause in rolling stock failures.

1.3 Traffics

1.3.1 Overall

	Passenger turnover		Freight turnover	
	th. pass . km	% of 1989	th. ton . km	% of 1989
1989	3,238,000	100 %	17,128, 000	100 %
1990	2,813, 000	87 %	15,477, 000	90 %
1991	2,455, 000	76 %	12,117, 000	71 %
1992	1,213, 000	37 %	3,512, 000	20 %
1993	1,003, 000	31 %	1,552, 000	9 %
1994	1,168, 000	36 %	955, 000	6 %
1995	371, 000	11 %	1,246, 000	7 %
1996	380, 000	12 %	1,141, 000	6 %

1.3.2 Passenger traffic in 1996

domestic main line	1,400,424
domestic suburban	1,604,513
transit	0
international	3,195
TOTAL	3,008,132

Traffic up to 60 km is regarded as suburban.

1.3.3 Freight traffic

Total tonnage in 1996 was 3,305,300 tonnes, plus transit traffic. Imports of 1,924,500 t are included, but no separate record is kept of exports which are also included. (I cannot believe this!)

Average freight haul by calculation is thus 341 km.

Transit traffic is not recorded in tonnes but in wagon loads. Wagon loads were 107,329.

A separate figure for transit was 2,612,500 tonnes.

1.4 Train operation

The communication system on the railway is currently not working, and therefore it is not possible to control train movements other than by only one letter! There appears to be no centralised signalling, everything being done at local control posts.

The semi-automatic block signalling is also defunct except for 60 km of track to the east of Tbilisi toward the Azerbaijan border. The railway is endeavouring to rebuild this semi-automatic block signalling.

In any case the track condition, inoperative signalling and lack of communications currently limits average train speed to as low as 5 to 10 km/h.

90% of the traffic on the main line is transit freight to and from the two Black Sea ports of Batumi and Poti through to Azerbaijan and Armenia.

The mountainous territory limits the trailing weight of the trains. In this area it requires three locomotives (two on the head and one pushing) to operate the trains which are limited to 2,500 to 3,000 tonne on this part of the route. The use of a pusher also helps to reduce the coupler stresses in the leading wagons of the train formation. A single locomotive can handle trains of 5,000 tonne to 7,000 tonne on other stretches of the line.

Trains of over 3,100 tonne require special notice to run from Zestafoni to Khashuri as they are restricted in the number of places they can stop due to inability to start such heavy trains on the grades.

It is worth noting that train operations in the westbound direction are not so severe, as the grades to the summit at Khashuri more gradual, and it is possible for a single locomotive to haul the trains. However, for descent from Khashuri to Zestafoni two locomotives are put on the head of the train for brake power, particularly holding brake effect should the train be brought to a stop on the steeply graded sections.

There are several locomotive depots on the network. The depot at the port city of Batumi provides the power for trains from there and Poti to Samtredia. The section to Zestafoni is worked by locomotives from Samtredia. At Zestafoni the Samtredia locomotives are detached to work back and locomotives based at Zestafoni take over for movement on the heavily graded section to Khashuri.

There is another locomotive depot at Khashuri from which locomotives operate to Tbilisi. The depot at Tbilisi provides the locomotives for operations to Azerbaijan and Armenia.

The maximum number of locomotives used on the head of the train is two B-B twin units. This may also be indicative of concern in regard to concentration of locomotive weight on bridge structures and track formation in general.

The railway in Georgia is dependant on transit traffic and this is only a small percentage of the volume in former days. However, the fixed costs of the operation have not declined in line with revenue reductions and the result has been that in the absence of suitable cash flow levels maintenance expenditure has been cut back. This has affected all areas of the railway from track and bridges to locomotives and rolling stock. In fact there is a summation effect in that the current track conditions contribute in turn to higher maintenance requirements.

2. Rolling stock

2.1 Locomotive fleet

Diesel Locomotives:				Electric Locomotives				
Model	Working	Stored / Defunct	Total	**Model**	Working	Stored	Defunct	Total
ChME3	41	113	154	**VL22**	6	0	10	16
TEM2	11	14	25	**VL8**	27	8	52	87
TE3	1	6	7	**VL10**	16	7	63	86
2TE10u	2	1	3	**VL10u**	1	1	16	18
2TE10m	2	4	6	**VL11**	9	6	26	41
TOTALS	**57**	**138**	**195**	**TOTALS**	**59**	**22**	**167**	**248**
Diesel Locomotives:				**Electric Locomotives**				

Each of the 3,300 VDC electric locomotive types consists of twin B-B units. The oldest electric locomotives, Class VL8, date from 1954 and are now beyond their economic working life with only a few remaining in service. Georgian State Railways consider the useful life of a locomotive to be 27 years.

Locomotives have been "robbed" of parts to keep others in traffic. Often three locomotives are used to obtain sufficient parts to make one operational, and it sometimes even takes four locomotives to achieve this. Ten of the "robbed" locomotives are currently in the Locomotive Building Factory for rehabilitation, and there are ten other locomotives which have been wrecked in collisions and derailments.

2.2 Passenger and freight wagons

The passenger car fleet consists of 1,176 vehicles of which 534 are currently operational. There are nearly 20,000 freight wagons in the fleet, of which only about 5,000 are currently operational.

Passenger Car Fleet	
Compartment Cars (2 berth)	69
Compartment Cars (4 berth)	436
Open Saloon Cars	516
Restaurant / Kitchen Cars	41
Buffet Cars	3
Luggage Vans	28
Postal Vans	3
Parcel Vans	38
Country Trains	25
Railway Officers Saloons	5
Engineering Inspection Saloons	6
Video Cars	2
Prison Vans	4
TOTAL	**1176**
Cannibalised for Spares	187
Out of Service (over age)	18
Left in Abkhazetia region	405
OPERATIONAL (as at 18/09/95)	**566**
(as at 24/05/96)	**534**

Recently a fleet of 780 Refrigerator Wagons was scheduled to be supplied as part of the World Food Programme. However, not all were delivered and a great many of them are now out of action as they "robbed" of parts to keep others in service.

The mountain territory contributes considerably to wagon wear and tear. The sharp curves cause considerable wheel wear which results in a short life of one year for the wheels compared to three years for vehicles not working in this region.

Freight Car Fleet	
Closed Wagons (Box Cars)	3,901
Flat Wagons (Platforms)	2,224
Open Wagons (Gondolas)	5,874
Tank Wagons	2,284
Grain Hoppers	1,910
Refrigerator Wagons	752
Various (including service vehicles)	2,017
Private Owner Wagons	869
TOTAL (All Types)	**19,831**

3. Maintenance facilities

3.1 Overall

Heavy maintenance and repair of locomotives passenger cars and freight wagons is carried out at two plants in Tbilisi. There is one repair shop for locomotives, carriages and wagons, and a locomotive building facility. The former now only handles passenger and freight cars whilst the latter now undertakes locomotive overhaul and repair as it is under utilised since the cessation of substantive locomotive construction.

Spare parts are hard to come by as the traditional source for everything was Russia or the Ukraine. Many items are of bespoke Soviet design and as such are not readily interchangeable with Western equipment without the replacement of complete systems e.g. brake equipment. Spare parts have not been traditionally manufactured in Georgia, but the current pressing situation is driving the railway to adopt some degree of self sufficiency. However, the current source for the majority of parts required is from stopped vehicles which are "robbed" to keep others in traffic.

3.2 Locomotives maintenance facilities

Locomotives Depots for running maintenance	Year of construct improvt	Number of bays	Capacity TO3,TR1 ,2 / year	Comments
Gurjaini				
Tbilisi Passenger				
Tbilisi Freight	1991	12		It's able to carry out up to TR2
Kharushiri				
Kutaisi				
Samtredia				
Batumi				

3.3 Passenger coaches maintenance facilities

3.3.1 Summary of maintenance facilities

Passenger coaches Depots for running maintenance	Year of construct improvt	Number of bays	Capacity DR / year	Comments
Tbilisi		10	360 DR	Poor condition 140 workers covered & opened wagons/refrigerators
Workshop for overhaul - KR	Year of construct improvt	Number of bays	Capacity KR / year	
Stalin plant				Not designed for, but relevant

3.3.2 Tbilisi passenger coach depot

Depot

The depot is the central plant for passenger coach repairs for the whole of Georgia. There is a train preparation depot near the main station which is a subsidiary of this depot. Some repairs are also carried out in Batumi and in Abkhazia. At four year overhaul (KR) work goes to the Stalin plant. New coaches do not come in for annual repair (DR) for two years.

The depot consists of a bogie repair shop and a body repair shop.

There are two Rafamet wheel lathes-SKC 14K (1990) and UBB112 (1981), and one Russian K3TC - all above floor. output when all three lathes are in use is 25 wheel sets per day.

The body repair shop consists of two lines holding approximately five coaches each. There are small side shops for components, currently little used.

Structures are in reasonable condition, however the floors are not good.

Coach repair

Unlike the freight depots, where wheel set replacement is the policy, the depot dismantles and overhauls axle bearings. 60% of bearings require attention and of these 20/30% require replacement. (No wonder with the conditions under which repair takes place.)

All wheels are turned annually, as a matter of policy.

There were no materials available for repairs in the body repair shop. The main activity appeared to be applying yet another annual coat of paint.

Output

The depot carries out annual repair (DR) only. TO1, TO2 and TO3 maintenance is undertaken at the train preparation depot.

Monthly output is DR : 25-30.

In addition the depot has an arrangement to repair 10 refrigerator generator/compressor units per month.

Staff

There are 140 workers at the depot, on a single shift. The staff also cover inspections and repairs at the passenger train preparation depot.

Other information

The parts store was a windowless shed full of second hand body parts which has been thrown in haphazardly.. The only new parts seen were about 100 new axle bearings, which were stacked roughly against a wall at an angle, without protection. New bearings put into service after such storage conditions would not last very long.

27 five car refrigerated sets were repaired at Tbilisi Passenger Car Depot in 1996.
It was reported that they can repair 10 generator cars per month.

3.4 Wagon maintenance facilities

Wagons Depots for yearly TR	Year of construct improvt	Number of bays	Capacity TR / year	Comments
Khashuri	1984		2100 DR	Bad conditions 400 workers covered & opened wagons
Samtredia	Built :1935 Rehab : 1956		1856 DR	Unbelievable conditions 454 workers Dumper
Batumi	1893 1968		1100 DR	Poor conditions 380 workers Tank wagons
Workshop for overhaul - KR	Year of construct improvt	Number of bays	Capacity KR / year	Comments
Batumi	1893 1968		69 KR	

3.5 The "Lenin" locomotive construction plant

This facility, located in Tbilisi, occupies a site of 47 hectares. In the days of the Soviet Union it was capable of building 150 electric locomotives per year. The facilities were built in the late 1950s early 1960s and the buildings are spacious.

Construction of VL10 type locomotives commenced at the plant in 1961 and the VL11 model followed from 1975. The higher speed version, type E13, was built from 1985 on. In total the plant has built some 3,500 locomotives and supplied 30% of the locomotives for the former Soviet Union.

Currently they are not building main line electric locomotives although they have the capability to construct three design; VL10, VL11 and E13. The last two VL11 locomotives constructed are still on hands as the Transport Co-ordinating unit has no funds to purchase them. However, an order for two industrial shunting locomotives is currently being filled for China; one being complete and awaiting inspection and the other well advanced. further orders for this type of locomotive are being pursued with the Russian Federation and Pakistan.

There are currently 6 of the VL11 type of locomotive undergoing repairs in the shop and a further 4 are awaiting attention. These units have been "robbed" of parts by the railway to keep other units in service. In addition a solitary VL15 unit, which has proved unsuitable for operation in Georgia is being dismantled for reclamation of components and sale of those items which it is not possible to use on standard models.

The plant was designed to be totally self sufficient and had its own machining and forging capability. All mechanical parts except wheels were manufactured in the plant, the latter being sourced from Russia. The facility had the capability to produce 90% of the brake equipment required for locomotives, the other 10% coming from Russia.

All electrical machines such as traction motors and compressor motors were manufactured in house as well as electrical switch gear and wiring harnesses.

The staff has been reduced from 5,000+ to around 2,500 in total, of which 10% are technical and administrative personnel. in addition to the General Manager, the "Top Team" consists of a Chief Engineer, Deputy GM (Production Engineering) and Deputy GM (Commercial & Supply). There are Department Heads for each of the main areas of Technical, Industrial and Construction, and each shop area has a Superintendent. The cash flow situation is currently so bad that the staff have not been paid for five months.

Due to financial and supply problems there are raw material and spare parts shortages in all areas. There is a critical shortage of wheels, bearing and batteries. However this plant has some tape controlled lathes which are used for batch production of turned items, but output is limited by availability of raw material. In general the machinery in the plant was more modern than that observed in the "Stalin" Rolling Stock Repair Plant.

3.6 The "Stalin" rolling stock repair plant

Like the "Lenin" locomotive construction plant there was little evidence of activity in the "Stalin" rolling stock repair plant even though there were at least twenty passenger carriages in for repair. Once again, lack of finance to buy materials and parts and to pay for the running costs of the plant were cited as reasons for the low output. It was also claimed that there was a lack of work due to shortage of electricity, but it was not determined if this was a real shortage or due to inability to meet payments for electricity.

There is currently a deficit of Lari 700,000 (US $560,000) in payments due from their sole client (Georgian Railways). This cash flow problem inhibits purchase of raw materials and spare parts, for example a stock of 15,000 m^3 of timber for wagon repair has now been completely depleted. The other most urgent problem is a lack of wheels.

Although locomotive overhaul and maintenance used to be carried out in this facility it has since been transferred to the Locomotive Construction Plant. This facility is now concentrating on passenger and freight car repair and maintenance. Additional freight car maintenance has been taken on since the beginning of the year in the locomotive maintenance bays. If there is no problem with material supply it is estimated by plant management that an output of 60 vehicles per month can be achieved.

However, the plant and machinery in the workshops is old fashioned, labour intensive, and depends on individual skills to maintain tolerances. There are no auto lathes or numerically controlled machines. This is not satisfactory if reliability of equipment is to be achieved.

There are ten lines in the plant connected by a traverse. Of these lines 1 & 2 are used for underframe repairs, 3 & 4 for "off the vehicle" activities and 5 & 6 are used for passenger carriage body finishing. Lines 7 & 8, formerly used for locomotive repair, are now used for freight wagon repair. Bogie overhaul is undertaken on lines 9 & 10 adjacent to which is the wheel and axle repair shop. In the latter new axles are even turned up on the lathes, but there is a lack of suitable steel, which is normally obtained from Russia. Wheels and journal bearings also currently come from Russia.

The plant has a staff total of 2,000 of which 150 are administrative or supervisory posts. Management is still very much on the "command & control" principle with very little empowerment to shop floor workers in regard to task objectives. Although the workers have been trained well as artisans they depend heavily on instructions for each task. Supervision appears to concentrate on getting the task in hand complete, dealing with material shortages and necessary rework of items which should be scrapped. As a result it appears that forward planning is not a priority and that the urgency is directed to completing the task in hand. Performance is measured on the antiquated basis of "fulfilment of directions"

4. Future requirement evaluation

4.1 Assumption

4.1.1 Traffic forecast for the next 10 years

year		1995	%	2000	2005
Passenger turnover	**th. pass.km**	**380,000**	**100%**	**380,000**	**380,000**
Long distance	th. pass.km	316,000	83%	316,000	316,000
Commuters	th. pass.km	64,000	17%	64,000	64,000
Total ridership	**th. pass**	**3,000**	**100%**	**3,000**	**3,000**
Long distance	th. pass	1,400	47%	1,400	1,400
Commuters	th. pass	1,600	53%	1,600	1,600
Freight turnover	**th. t.km**	**1,141,000**		**1,141,000**	**1,255,000**
Total freight	**th. t**	**5,260**		**5,260**	**5,790**
Imported by rail	th. t	1,920		1,920	2,120
Exported by rail	th. t				
Transit	th. t	2,612		2,612	2,870
Domestic traffic	th. t	728		728	800

4.1.2 Operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1/2	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	8	8	14	14	18
Annual average distance run	km	10,063	45,103	191,628	190,896	283,179
Freight trains						
Average speed	km/h	25	25	40	40	40
Average train load	t	3,000	3,000	3,000	3,000	2,500
Average wagon load	t	59	59	50	50	50
Wagon turn around	days	17	17	10	10	8
Annual distance run per wagon	km	2,130				

			17,749	42,171	42,171	52,713
Passenger trains						
Average speed	km/h	30	30	50	50	80
Average train ridership	pass	180	180	100	100	250
Average coach per train		9	9	5	5	5
Annual distance run per coach	km	13,435	39,130	93,913	93,913	150,261

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	257	57	21	21	8
Freight trains		21	5	6	5
Passenger trains		37	16	16	3
Diesel locomotives	9	2	1	1	
Electric locomotives	248	55	20	21	8
Shunting locomotives	186	30	35	35	25
Passenger coaches	1,176	404	168	168	42
Wagons - total	21,250	2,690	2,130	2,350	1,880
Open - PV	5,800	710	570	620	500
Tank - TS	2,950	900	720	790	630
Covered - KR	4,800	360	290	310	250
Refrigerator - XX	900	30	20	25	20
Platform - PL	2,690	120	90	105	80
Hopper - ZR	1,250	170	130	150	120
Others	3,120	320	250	280	220

4.3 Maintenance facilities requirements

4.3.1 Locomotive maintenance facilities

Main line locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of electric main line locomotive units	496	111	40	41	8
Annual run of a locomotive km	10,063	45,103	191,628	190,896	283,179
Running inspection					
Production of TO3 / TR1	9,920	2,213	804	824	24
Production of TR2	496	111	40	41	8
Production of TR3	248	55	20	21	
Overhaul					
Production of KR	37	8	3	3	1

Diesel main line locomotive

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
umber of units of the diesel main line locomotive	18	4	1	1	
nnual run of a locomotive km	10,063	45,103	191,628	190,896	283,179
unning inspection					
Production of TO3 / TR1	360	80	29	30	1
Production of TR2	12	3	1	1	
Production of TR3	6	1			
Overhaul					
Production of KR	4	1			

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	186	30	35	35	25
Running inspection					
Production of TO3 / TR1	1,860	300	350	350	50
Production of TR2	74	12	14	14	8
Production of TR3	47	8	9	9	4
Overhaul					
Production of KR	26	4	5	5	4

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	1,176	404	168	168	42
nnual run of a passenger coach km	13,435	39,130	93,913	93,913	150,261
Running inspection					
Production of TO2	1,176	404	168	168	42
Production of TO3	1,176	404	168	168	
Overhaul					
Production of KR	235	81	34	34	8

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	19,831	2,380	1,182	1,508	1,207
Annual run of a wagon km	2,130	17,749	42,171	36,346	45,433
Running inspection					
Production of TR	19,831	2,380	1,182	1,508	1,207
Overhaul					
Production of KR	1,983	238	118	151	121

5. Recommendations

5.1 Management

It is recommended to set up a central maintenance management as described in the Part 2 Chapter 3 of this report. The line inspection and the drivers (first level) have to be managed by the train operation department.

That central department will define the maintenance rules, the equipment upgrading and procurement and will co-ordinate resource sharing between depots and workshops. It will also be in charge of the spare parts procurement co-ordination. Special attention has to be paid to maintenance monitoring and failure follow up.

Each depot and workshop will be organised in business unit.

At a very short term basis it is highly recommended to deal with the spare parts procurement management in order to purchase the required spare parts and to implement a spare parts management system.

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level.

USD 3 millions have to be allocated for consulting services, logistics and computers.

5.2 Rolling stock

5.2.1 Locomotives

To deal with the current situation, 87 locomotives are required : 57 main line locomotives 30 shunting.

400 are available : 89 main line locomotives and 63 shunting.

However, most of the locomotives are old, the youngest ones still can be used about 10 years if the proper maintenance is performed and original spare parts are used

Improvements of train operation performances could allow to reduce even more the fleet to 25.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 10.

Thus, no investment for new locomotives procurement is required over the 10 next years.

New generation of locomotives should be introduced at a long term basis. However, prior to introduce new rolling stock, track infrastructures should be improved, operation and maintenance should be restructured. Doing that, it is likely that the locomotive fleet required well drop from 60 to about 10.

Since new generation of locomotive is to be introduced within 10-15 years, it is recommended to perform test with one or two of the new generation locomotives.

USD 5 millions have to be allocated for 2 new locomotives.

5.2.2 Passenger coaches

For the time being, 170 of the 400 passenger coaches are required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches will appear is the next years, the existing ones will be needed during at least 10 to 15 years for long distance services.

Inter-city trains are likely to replace, most of the long distance coaches, therefore, it is proposed to rehabilitate 50 % of the current operated fleet.

USD 50,000 have to be allocated to each of the 100 coaches during the 10 next years.

5.2.3 Wagons

The fleet of existing wagons (21,000) is large enough to cover the current needs (2,600). Improvements of operation performances will allow to reduce such needs to 1,900.

A specific case study has been performed in the scope of that project - see Georgia case study in Part 4 of this report. The wagon conditions as well as their available and required quantities have been analysed. Actions are proposed to rehabilitate a relevant wagon fleet.

In case of the case study recommendations are not implemented within next 10 years, 1,000 wagons should be refurbished or replaced.

USD 20,000 have to be allocated for refurbishment of each of 1,000 wagons or procurement of new ones

5.3 Maintenance facilities

5.3.1 Locomotives

The Georgian railways have presently to maintain 30% of their locomotive fleet. When infrastructure will be improved, train operation and maintenance will be refurbished, they will have to maintain 10 % of their existing fleet.

Therefore, it is recommended:

- at a short term basis to gather maintenance activities in Tbilisi Freight Locomotive depot, Samtredia, Kutaisi, Gurjaini.
- at a long term basis to gather activities in Tbilisi and Samtredia

USD 5 million is to be allocated to Tbilisi and Samtredia depot restructuring.

Lenin workshop should be restructuring to deal with overhaul of all kinds of vehicles.

USD 5 millions have to be allocated for Lenin workshop restructuring.

5.3.2 Passenger coaches

Tbilisi depot should be restructuring to deal with running maintenance of the whole passenger coach fleet.

USD 2 millions have to be allocated for the depot restructuring.

It is proposed to perform the overhauls in Lenin workshop.

5.3.3 Wagons

In order to carry out the running maintenance of the 2,600 wagons required to deal with the current situation, 2 of the 3 depots are necessary. All maintenance activities could be gathered in Batumi and Kasuri depots, which have to be deeply refurbished.

USD 5 million is to be allocated for each of them.

Overhaul should be performed in Lenin and Batumi workshops

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph includes an efficient spare parts management system. However, it needs several years to be implemented and the railways will not be able to survive more than 2 or 3 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 6.3 millions have to be allocated to the urgent needs of spare parts.

5.5 Manufacturing

The Rolling Stock Repair Plant in Tbilisi can handle all the necessary passenger and freight car overhauls, but it is in need of a major tidy-up and some modern machinery for the production of common components.

The Locomotive Building Plant is a relatively modern facility and is spacious. It has great potential to be developed into a major locomotive overhaul and repair centre. However, in both shops there will be a need for supporting materials management to back up production activities.

Effective use of any capital investment must be assured, and it is imperative that any such projects be evaluated properly and that sufficient transfer of know how is given to back up the introduction of new plant methods and techniques.

The Stalin plant offers many advantages for rolling stock construction :

- central position in Caucasus countries ;
- wide and well distributed construction sheds linked by wide ways and roads ;
- buildings in good conditions ;
- skilled workers.

However, the plant has not produced locomotives for several years, therefore, improvements of working areas, cleaning, restructuring of production lines are compulsory to plan new construction.

Most of the engineers and management have left the plant and training will be required to design new production lines.

Control quality system and specialised inspection team should be set up and trained. New certification of the plant is required including agreements of the future customers of the production means, sub equipment used and quality control procedures.

New technology of locomotives is to be used in order to comply with the modern requirements. New technology involves new tooling and new sub equipment also using modern technology well adapted to the new economical environment. In particulate, the electronic and synchrony or asynchrony motors have enabled engineers to design rolling stock which gathers higher reliability with higher performances, higher maintainability and availability.

Therefore, it not recommended to re-start the production as it was, but to restructure the plant to comply with the new constraints to cope with.

Joint venture or other co-operation with western manufacturer which has already a fair experience of a new technology is recommended so as to :

- take advantage of already tested rolling stock and to avoid
- acquire the relevant tooling ;
- benefit of transfer of know how ;
- benefit of wide production of inter- changeable components which could be purchased in a wide and opened market.

Capacity of the future plant

A thorough market survey should be performed, however, the current study proposes an investment plan of rolling stock for the whole TRACECA area.

As already stated, no new rolling stock are needed urgently, however, the current rolling stock should be changed by a new one within 10 to 20 years, and the implementation of a new construction plan could required several years.

Production plan : after 2005, an estimate 50 electric locomotives should be produced per year for the whole TRACECA region.

USD 50 millions is to be allocated for the modernisation of the plant.

5.6 Investment plan for the next 10 years

Investment USD million	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	6,3	
Restructuring - M I S system	3	
Locomotives		5
Passenger coaches	2.5	2.5
Wagons	10	10
Locomotive maintenance facilities	5	5
Coach maintenance facilities	2	
Wagon maintenance facilities	5	10
Manufacturing facilities		50
Total	33.8	82.5

Annex 1 : Attachment of the electric locomotives

Type	Depot	Total fleet	OUT OF SERVICE			Available	Roster
			Parts	Works	Repair		
VL22	GURJAANI	0	0	0	0	0	
	TBL PASS	0	0	0	0	0	
	TBL FGT	0	0	0	0	0	
	KHASHURI	0	0	0	0	0	
	KUTAISI	13	4	0	3	6	
	SAMTREDIA	0	0	0	0	0	
	BATUMI	1	0	0	0	1	
	TOTAL	14	4	0	3	7	
VL8	GURJAANI	0	0	0	0	0	
	TBL PASS	26*	0	0	5	17	
	TBL FGT	0	0	0	0	0	
	KHASHURI	2	0	0	0	2	
	KUTAISI	0	0	0	0	0	
	SAMTREDIA	54	26	0	8	20	
	BATUMI	0	0	0	0	0	
	TOTAL	82	26	0	13	39	
VL10	GURJAANI	0	0	0	0	0	
	TBL PASS	0	0	0	0	0	
	TBL FGT	40	26	0	4	10	
	KHASHURI	55	36	0	11	8	
	KUTAISI	6	0	2	1	3	
	SAMTREDIA	0	0	0	0	0	
	BATUMI	0	0	0	0	0	
	TOTAL	101	62	2	16	21	
VL11	GURJAANI	13	9	0	0	4	
	TBL PASS	0	0	0	0	0	
	TBL FGT	21	9	0	2	10	
	KHASHURI	7	4	0	1	2	
	KUTAISI	0	0	0	0	0	
	BATUMI	0	0	0	0	0	
	TOTAL	41	22	0	3	16	
	GRAND TOTAL	**238**	**114**	**2**	**35**	**83**	**57**

Annex 2 : Attachment of the shunting locomotives

Type	Depot	Total fleet	OUT OF SERVICE			Available	Roster
			Parts	Works	Repair		
TEM2	GURJAANI	0	0	0	0	0	
	TBL PASS	4	0	0	0	4	
	TBL FGT	0	0	0	0	0	
	KHASHURI	3	3	0	0	0	
	KUTAISI	3	3	0	0	0	
	SAMTREDIA	10	9	0	0	1	
	BATUMI	9	7	0	0	2	
	TOTAL	29	22	0	0	7	
TE3	GURJAANI	0	0	0	0	0	
	TBL PASS	1	0	0	0	1	
	TBL FGT	0	0	0	0	0	
	KHASHURI	0	0	0	0	0	
	KUTAISI	0	0	0	0	0	
	SAMTREDIA	0	0	0	0	0	
	BATUMI	0	0	0	0	0	
	TOTAL	1	0	0	0	1	
ChME3	GURJAANI	15	10	0	0	5	
	TBL PASS	44	22	0	0	22	
	TBL FGT	0	0	0	0	0	
	KHASHURI	19	9	4	0	6	
	KUTAISI	6	1	0	1	4	
	SAMTREDIA	43	4	15	10	14	
	BATUMI	18	5	6	3	4	
	TOTAL	145	51	25	14	55	
	TOTAL SHUNTERS	175	73	25	14	63	28

Annex 3 : Attachment of the diesel mainline locomotives

Type	Depot	Total fleet	OUT OF SERVICE			Available	Roster
			Parts	Works	Repair		
2TE10	GURJAANI	0	0	0	0	0	
	TBL PASS	0	0	0	0	0	
	TBL FGT	1	0	0	0	1	
	KHASHURI	8	0	3	0	5	
	KUTAISI	0	0	0	0	0	
	BATUMI	0	0	0	0	0	
	TOTAL	9	0	3	0	6	6*

Annex 4 : Attachment of the Electrical Multiple Units

Type	Depot	Total fleet	OUT OF SERVICE			Available	Roster
			Parts	Works	Repair		
ER2	GURJAANI	0	0	0	0	0	
	TBL PASS	300	200	0	0	100	60 (10x6)
	TBL FGT	0	0	0	0	0	
	KHASHURI	4	0	0	0	4	4 (1x4)
	KUTAISI	44	10	0	0	34	20 (5x4)
	SAMTREDIA	0	0	0	0	0	
	BATUMI	34	4	0	0	30	12 (6x2)
	TOTAL	378	214	0	0	168	96
SR3	GURJAANI	0	0	0	0	0	
	TBL PASS	0	0	0	0	0	
	TBL FGT	0	0	0	0	0	
	KHASHURI	3	0	0	0	3	3 (1x3)
	KUTAISI	4	0	0	0	4	4 (1x4)
	SAMTREDIA	0	0	0	0	0	
	BATUMI	0	0	0	0	0	
	TOTAL	7	0	0	0	7	7
	TOTAL RAILCARS	**385**	**214**	**0**	**0**	**175**	**103**

KAZAKHSTAN Railways

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Annexe to this chapter

Attachment of existing locomotives

1. Overall

1.1 General situation of the railways

Kazakhstan is the only country of the TRACECA corridor to have connections to Russia, China and the Caspian Sea, which brings it a major transit role between those countries and Uzbekistan, Kyrghyzstan, Tadjikistan and Turkmenistan.

Its long border with Russia, its economic position as partner and provider to Russia and its strategic position vis a vis the other countries, explain, among other things, its tight relationships with Russia.

The breakdown of the FSU, implied the same deficiencies than the other countries : spare parts procurement, overhaul maintenance facilities, management.

The Kazakhstan Railways is the largest network and own the most important fleet of rolling. Its own fleet is as large as the whole fleet of the seven others TRACECA countries who face the same difficulties.

The railways were managed by the Ministry of Transport and divided into three independent networks.

The three networks were declared in bankrupt in November 1996, and gathered into one unique network in February 1997, under the control of KAZCOMMERZBANK who is creating a single management. Since the general organisation is changing, the new management are taking decisions to give up some non-profitable services. The lfeet of rolling stock and maintenance facilities wil have to be adapted accordingly.

1.2 Network

1.2.1 Description of the network

The three former networks were gathered into one, however, the Tselinya, Almaty and West Kazakhstan are often mentioned.

The length of the whole network is 13 500 km of which :

- Double tracks 3 540 km
- Partially double tracks 1 150 km
- Single tracks 8 820 km
- Electrified 3 300 km

93 main stations and about 900 stops which enable train crossing

The network is mainly constituted of 3 main lines:

- The former Stelinya network constituted of the North - South line, through Akmola, Shu and Chengeldy at the Uzbek border (1,650 km), connects the Trans Siberian line to Uzbekistan. This line is fitted with double tracks and is electrified in 25 Kv 50Hz in most of its length. At Akmola, it receives an East branch coming from Ekibastuz, the most loaded branch of Kazakhstan network and a West branch coming from Tobol and the Russian border.
- The former West Kazakhstan network constituted of the South - North West line, from Arys to Aktubinsk (1377 km, double track) and Ozinky at the Russian border (570 km, single track) connects Uzbekistan to Russia (line to Moscow). At Kandagach (Northern part), the line receives the Western branches coming from Atyrau and Aktau on the Caspian Sea. This line is not electrified.

- The former Almaty network constituted of the South - North East line, from Shu to Semipalatinsk (1280 km, mainly non-electrified single track). At Aktogay, it receives an East branch coming from Drujba, at the China border and a West branch coming from Mointy on the Shu - Akmola line.

1.2.2 Conditions of the networks

The lines which are electrified are in pretty good conditions, and they are fitted with double tracks, The line connected Almaty to China, in the Trans Asia line and the main line to Moscow are also in pretty good conditions, and partially fitted with double tracks. However the secondary lines face problems of maintenance and the speed is limited in many places.

It should also be pointed out that the main link to Moscow is not electrified. Obviously the electrified line follow the corridor of minerals resources (Karaganda, Pavlodar, Ekibastuz, Akmola)

On the whole network, every 15 km, stations or train stops allow train crossing. They are fitted with shunting tracks allowing crossing of 850 m long trains.

1.3 Traffics

The Kazakh freight traffic was one of the most important in the world, and it is still as high as European most important traffics.

The freight traffic has drastically decreased during the last seven years, the passenger traffic has been kept constant during the same period.

1.3.1 Freight traffic

Formally very high, the traffic is still high since it was about 200 million tonnes in 1995, and, due to the long distance to be covered in that country, the turnover in tonne x km is also very high, which requires important fleets.

However, part of those high figures result from the commuter traffic of coal in Karaganda region.

Year	Min tonnes	Bln tonne x km
1980	308	354
1985	337	382
1990	345	407
1991	328	374
1992	289	286
1993	218	190
FRANCE	120	45
GERMANY	291	65

The transit traffic is not included in the table, it represents about 25% of the traffic

Freight traffic per main categories of product

	1989	% of total 89	1992	% of total 89
Coal	128.90	24.77%	117.70	31.38%
Oil products	25.50	4.90%	19.90	5.31%
Metals	7.00	1.35%	6.00	1.60%
Minerals	47.60	9.15%	37.10	9.89%
Materials for construction	72.50	13.93%	53.20	14.18%
Chemicals	17.90	3.44%	9.50	2.53%
Grains	7.80	1.50%	9.00	2.40%
Others	36.10	6.94%	23.80	6.34%
Transit traffic	177.10	34.03%	98.90	26.37%
Total	**520.40**	**100.00%**	**375.10**	**100.00%**

It should be pointed out that 50% of the traffic is constituted of :

- the coal traffic between Exinbastuz and Karaganda,
- the construction materials, evenly distributed in the country and,

1.3.2 Passenger traffic

It has been rather constant and heavy since it represents almost 3 times the population of the country.

Year	Min pass	Bln pass x km
1980	37.1	14.8
1985	34.1	15.8
1990	42.6	19.7
1991	40.0	19.4
1992	39.7	19.7
1993	41.2	20.5
GERMANY	1420	57
FRANCE	814	58
Paris area	553	10

Daily trips of passenger trains :

- on electrified lines : 546 km
- on diesel lines : 527 km

The train are often very loaded, however, the real demand is not known and the level of fraud is very high.

1.4 Operation

The train speed is very low, less than 40 km/h, due to :

- too much stops : even with some local trains (Almaty - Akmola, Almaty - Shimkent), the long distance trains (Almaty - Moscow) stop in many stations served by those local trains ;
- technical limits of the rolling stock : only one type of electric locomotive (VL80) can run at 110 km/h, the others are limited at 100 km/h and most of passenger coaches can run at 160 km/h in standard condition.

- long stop in stations : between 10 to 30 minutes (2 to 10 minutes in Europe)
- Single track on 70% of the networks, which involves idle time for train crossing.
- too much stops in marshalling yards and crossing stations for wheels and coupling inspections
- the track conditions could certainly not allow a higher speed than 100 km/h

2. Rolling stock

2.1 Locomotives

Since 25% of the network is electrified, therefore, the fleet of locomotives is constituted by electric locomotives (21 %) and diesel locomotives (57 %).

The fleet is larger than required for the operation and the idle locomotives are stored. Due to the lack of spare parts, some of the stored locomotives are cannibalised. It is difficult to get a reliable information on the quantity of unavailable locomotives, however, it was reported that about 45% unavailable for operation.

Moreover among this idle fleet, some of the locomotives are not canabalized, but they are thoroughly stored for strategic reasons.

The locomotives are considered as assets of the government and cannot be sold by the railway.

Even though, the entire fleet is not operated, the railway administration plans maintenance for the whole fleet which is useless and costly.

Due to the different characteristics of the trains to be hauled, locomotives for passenger trains are different than locomotives for freight trains. The passenger locomotives are less powerful than the freight locomotives, but they are faster, which is still the case for many railways in the world. But, the freight locomotives are used to haul passenger and freight trains, which is not efficient and costly. or the electric locomotives : VL60 et VL80.

Fleet of locomotives (year 1995)

Breakdown of the fleet

Type of locomotives	Number of locomotives	Percent of total	Number of units
Line - Diesel	1745	57%	3400
Shunting Diesel	689	22%	689
Electric	657	21%	1249
TOTAL	3091	100%	5338

For the Almaty network, on January 1996, the main line locomotive fleet was split as follows :

	Freight traffic	**Passenger traffic**	**Out of service**	**Other services**	**Total**
Diesel	14,9%	8,3%	23,1%	32,9%	79,4%
Electric	9,8%	3,8%		7,1%	20,6%
Total	24,7%	12,1%	23,1%	40%	100%

Age of the fleet

Type of locomotives	less than 5	less than 10	less than 15	more than 15	more than 20
Line - Diesel	125	360	509	601	
Shunting Diesel		140	227	366	
Electric		290.5	243	100	105
TOTAL	125	790.5	979	1067	105

Note : In those tables the locomotives are considered as multiplied units, not as separated vehicles.

60% of the fleet is less than 15 years old

2.2 Passenger coaches

Breakdown per age of the vehicles

Type of vehicle	Ref.	Before 1961	before 1971	before 1981	before 1986	before 1991	after 1991	Total
Reserved Seat Cars		4	95	526	205	351	16	1197
Standard Sleeping Cars	TSMK	2	170	95	121	177	36	601
Comfort. Sleeping Cars				7		10	3	20
Comfort. Sleeping Cars				5	29			34
Comfort. Sleeping Cars			3					3
Commuter Cars		25						25
Total		**6**	**293**	**633**	**366**	**538**	**55**	**1880**
Restaurants Cars			24	18	34	17	9	102
Others		37	131	27	2	4	2	203
Total		**43**	**448**	**678**	**402**	**559**	**66**	**2185**

50% of the fleet are less than 15 years old

2.3 Wagons

Type		Total	Out of order	Available	Required 1996
Closed wagons	**KR**	17 820	7 050	10 770	9 830
Opened wagons	**PV**	39 510	6 490	33 020	21 800
Plateform wagons	**PL**	14 130	5 900	8 230	7 800
Tank wagons 60 t - 2 bogies **120 t - 4 bogies**	**TS**	10 590 980	2 420	9 150	6 350
Refrigerator wagons	**XS**	2 240		2 240	1 240
Others		15 760	2 640	13 120	8 700
Total		**101 030**	**24 500**	**76 530**	**55 720**

Among the « others » are included : car-carriers and containers, cattle, grains, cement wagons

Speed limit of all types of wagons : 120 km/h

Average age of the fleet :

Built before 1961	8 520
Built between 1961 and 1981	53 410
Built after 1981	39 100
Total	**101 030**

40% of the wagons are less than 15 years old

3. Maintenance

There is few cooperation between depots of the same type of vehicles, and no relationships between locomotive, wagon and passenger coach depots and workshops.

The overhauls are carried out :

- in Russia and Uzbekistan for diesel locomotives
- in Russia for electric locomotives
- in Russia for the wagons except for the opened wagons which is carried out in Akmola
- in Almaty and in Russia for the passenger coaches.

Overhauls carried out in foreign countries are time consuming, costly and paid in hard currency. The foreing maintenance is reported to be costly mainly due to unconditional replacement of all components according to the maintenance rules which is not done when the maintenance is performed locally.

Maintenance records are stored in a book in the assigned locomotive depot. No statistics on failures, spare parts consumption, MTBF are performed.

3.1 Locomotives maintenance

3.1.1 General observations

42 depots are evenly distributed all over the country for the running maintenance of the locomotives. Among them, 9 are specialised for the electric locomotives.

- 41 are fitted to carry out TO, TR1, which are light preventive maintenance, mainly inspection
- 19 are fitted to carry out TR2 maintenance. TR2 is a standard preventive maintenance
- 7 are fitted to carry out TR3 maintenance (including 3 specialised for electric locomotives). TR3 is very similar to an overhaul maintenance.

On main line, the average distance between depots is 250 km, which is very short even for that technology, but this distribution is in relation to the maximum distance to be covered by the team driver / locomotive.

For the diesel locomotive, the tank of oil is filled up when go through a depot, therefore every 250 or 300 km.

3.1.2 Projects

Taking into account the large locomotive fleet, the Ministry of Transport plans to build new workshops for locomotive overhauls :

Overhaul workshop for diesel locomotives at KAZALINSK

Overhaul workshop for electric locomotives at BOROVOYV

Overhaul workshop for shunting locomotives at AKMOLA

3.1.3 Summmary of locomotive maintenance facilities

Depots for running maintenance	Capacity TO3,TR1 / year	Capacity TR2 / year	Capacity TR3 / year	Comments
Turkestan	1810 1580			Main line diesel Shunting diesel
Arys	1810 0	 250		Main line diesel Main line electric
Djambul	3620 520	138	230	Main line diesel Shunting diesel
Karatau	900 1050			Main line diesel Shunting diesel
Chu	4080 1050		230	Main line diesel Shunting diesel
Sary-	450			Main line diesel
Shagan	520			Shunting diesel
Almata	3620 1050	104 68		Main line diesel Shunting diesel
Sary-Ozek	1360 520			Main line diesel Shunting diesel
Matai	1810 520			Main line diesel Shunting diesel
Semipala-	900			Main line diesel
tinsk	520			Shunting diesel
Charskaya	1360 520			Main line diesel Shunting diesel
Ayauz	3620 520	138		Main line diesel Shunting diesel
Zatshita	1810 520	69		Main line diesel Shunting diesel
Esil'	900			Main line diesel
Novoshim skoye	2720 520			Main line electric Shunting diesel
Kurort	1360			Main line diesel
Tselinograd	3740 520	230	80	Main line electric Shunting diesel
Tobol	1020			Main line electric
	520			Shunting diesel
Kushmurun	520	78	70	Shunting diesel
Atbasar	1020	230	300	Main line electric
Kustanay	900 520			Main line diesel Shunting diesel
Ermentau	450	69		Main line diesel
Pavlodar	1360 520	69	300	Main line diesel Shunting diesel
Ekibastuz	3670 520			Main line electric Shunting diesel

Karaganda	4760 1050	230 69		Main line electric Main line diesel Shunting diesel
Zhana-Arka	1360 520			Main line diesel Shunting diesel
Balkhash	520			Shunting diesel
Agadyr	680	230		Main line electric
Kizil-Orda	3170 520			Main line diesel Shunting diesel
Saksaul skaya	2720 1050	138		Main line diesel Shunting diesel
Chiili	1360			Main line diesel
Chelkar	1360 520	138		Main line diesel Shunting diesel
Emba	2720 520	138		Main line diesel Shunting diesel
Aktubinsk	1810	69		Main line diesel
Shubar- Kudus	2720 520	138		Main line diesel Shunting diesel
Uralsk	2720 520	138		Main line diesel Shunting diesel
Makat	4980 520	138		Main line diesel Shunting diesel
Mangyshlak	1360 520			Main line diesel Shunting diesel
Guriev Atyrau	1360			Main line diesel
Kazalinskaya			230	Main line electric

3.2 Wagons

3.2.1 General observations

20 wagon depots are evenly distributed to carry out the light maintenance of wagons

Overhaul maintenance is done in specific workshops. There is only one of this workshop in Kazakhstan, at Akmola. It is specialised for the opened wagon maintenance.

In every terminal station, loading station and in marshalling yards, inspections are carried out.

The wagons should be maintained in the country where it is located when it reaches the annual periodicity. The date and location of the maintenance is painted on the wagon.

3.2.2 Projects

Taking into account the large locomotive fleet, the Ministry of Transport plans to build new workshops for locomotive overhauls :

Capital repairs and overhaul of the tank wagons in Djambul

Capital repairs and overhaul of frigorific wagons in Shimkent

3.2.3 Summary of wagon maintenance facilites

Depots for running maintenance	Year of construct or rehab	Number of bays	Capacity (TR per year)	Comments
Arys*	1936 1976	6	2570	platform; covered; tanks
Shimkent	1935 1989	7	3430	covered, low side, platform
Djambul	1924 1970	9	3860	covered, low side, tanks
Ayauz*	1935 1960	6	2570	covered, low side, platform
Semipalatinsk*	1936 1969	6	2570	covered, low side, platform
Zatshita*	1939 1982	12	5140	covered, low side, platform
K.-Borovoye	1935 1987	8	6000	covered, platform
Atbasar	1943	12	6000	covered, platform, low side
Zhelezno rudnaya	1965 1970	6	2060	platform, low side
Kushmu-run*	1942 1967	6	2070	covered, low side
Ekibastuz 1	1987	13	10000	platform, low side
Ekibastuz 2	1972	10	5800	low side
Pavlodar	1978 1992	10	5900	low side, platform, tanks
Karabas**	1980	2	300	low side
Karaganda	1935 1978	12	6200	platform, low side
Balkhash**	1938 1971	6	3500	low side, tanks
Kazalinsk*	1936 1983	5	2500	hoppers, covered, low side, contai-ners
Chelkar*	1936 1991	5	2500	platform, low side, service vehicles, cement wagons

Depots for running maintenance	Year of construct or rehab	Number of bays	Capacity (TR per year)	Comments
Uralsk*	1936 1982	6	3000	cement wagons, low side, containers trains, covered, hopper
Guriev (Atyrau)**	1944 1983	8	3000	container trains, tanks, low side, hoppers
Kizil-Orda	-	6	3000	covered platform low side

3.3 Passenger coaches

3.3.1 Passenger coaches maintenance facilities

3 coach depots are specialised for the light maintenance of the passenger coaches. They are located in Almaty, Akmola and Aktyubinsk.

The Almaty passenger coach depot carries out overhauls of electric motors.

Almaty workshop carries out overhauls of Kazakh passenger coaches and passenger coaches of neighbouring countries. However, those neighbouring countries are complaining about the low quality of the maintenance and the price requested.

3.3.2 Project

Plant for construction of passenger coaches in Almaty

4. Future requirement evaluation

4.1 Assumptions

4.1.1 Traffic forecast for the next 10 years

year		**1995**	**%**	**2000**	**2005**
Passenger turnover	**Th. pass.km**	**20 500 000**	**20 500 000**	**20 500 000**	**20 500 000**
Total ridership	**Th. pass**	**41 200**	**41 200**	**41 200**	**41 200**
Freight turnover	**th. t.km**	**190 000 000**		**209 000 000**	**209 000 000**
Total freight	**th. t**	**232,500**		**255,750**	**255,750**
Transit	th. t	58,000	25 %	64,000	64,000
Imported	th. t	8,300	4 %	10,200	10,200
Exported	th. t	33,500	15 %	37,400	37,400
Domestic	th. t	132,700	56 %	143,200	143,200
Breakdown of fretght per product					
Grain	th. t	5,800	3.3 %	6,300	6,300
Coal	th. t	75,400	43.2 %	82,900	82,900
Oil and oil products	th. t	12,800	7.3 %	14,000	14,000
Minerals	th. t	25,000	14.4 %	27,700	27,700
Chemicals	th. t	6,100	3.5 %	6,700	6,700
Construction materials	th. t	34,000	19.5 %	37,500	37,500
Others	th. t	15,300	8.7 %	16,700	16,700
TOTAL		174,400	100 %	191,800	191,800

4.1.2 Operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	10	10	14	14	18
Annual average distance run	km	44 620	115 200	174 088	173 094	290 653

Freight trains						
Average speed	km/h	40	40	40	40	50
Average train load	t	3 500	3 500	3 500	3 500	3 500
Average wagon load	t	70	70	70	70	70
Wagon turn around	days	7	7	6	6	6
Annual distance run per wagon	km	44 812	78 455	91 531	91 115	91 531
Passenger trains						
Average speed	km/h	40	40	60	60	90
Average train ridership	pass	1 500	1 500	800	800	640
Average coach per train		15	15	10	10	8
Annual distance run per coach	km	93 822	75 130	112 696	112 696	169 043

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	2,334	904	667	723	453
Freight trains		785	561	617	384
Passenger trains		119	106	106	69
Diesel locomotives	1,595	548	404	438	274
Electric locomotives	739	356	263	285	178
Shunting locomotives	733	400	400	300	300
Passenger coaches	2,185	2,085	1,733	1,733	1,516
Wagons - total	100 950	57,600	49,400	54,600	54,300
Open - PV	39,500	27,300	23,400	25,800	25,700
Tank - TS	11,500	8,600	7,300	8,100	8,100
Covered - KR	17,820	5,900	5,000	5,500	5,500
Refrigerator - XX	2,240	2,100	1,800	2,000	2,000
Plateform - PL	14,130	3,200	2,800	3,100	3,000
Others	15,760	10,300	8,800	9,800	9,700

4.3 Maintenance facilities requirements,

4.3.1 Locomotive maintenance facilities

Main line locomotives

		Existing	Short term		Long term	
		situation	Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel main lines locomotives		3 416	1 173	865	938	274
Annual run of a locomotive	km	44 620	115 200	174 088	173 094	290 653
Running inspection						
Production of TO3 / TR1		68 320	23 458	17 305	18 761	1 097
Production of TR2		2 255	774	571	619	181
Production of TR3		1 127	387	286	310	90
Overhaul						
Production of KR		683	235	173	188	41

Electric main line locomotives

		Existing	Short term		Long term	
		situation	Altern 0	Altern 1	Altern 1	Altern 2
Number of electric main line locomotives		1 314	634	467	507	178
Annual run of a locomotive	km	44 620	115 200	174 088	173 094	290 653
Running inspection						
Production of TO3 / TR1		26 280	12 673	9 349	10 136	535
Production of TR2		788	380	280	304	178
Production of TR3		434	209	154	167	
Overhaul						
Production of KR		263	127	93	101	18

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	733	400	400	300	300
Running inspection					
Production of TO3 / TR1	7 330	4 000	4 000	3 000	600
Production of TR2	293	160	160	120	99
Production of TR3	183	100	100	75	45
Overhaul					
Production of KR	103	56	56	42	45

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	2 185	2085	1733	1733	1 516
Annual run of a passenger coach km	117 277	75 130	112 696	112 696	169 043
Running inspection					
Production of TO3	2 185	2085	1733	2 274	1 516
Production of DR	2 185	2085	1733	2 274	
Overhaul					
Production of KR	437	417	347	347	303

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	100 950	57 661	49 424	54 614	54 366
Annual run of a wagon km	44 812	78 455	91 531	91 115	91 531
Running inspection					
Production of TR	100 950	57 661	49 424	54 614	54 366
Overhaul					
Production of KR	10 095	5 766	4 942	5 461	5 437

5. Recommendations

5.1 Management

The wide restructuring of the three networks in one company is in progress. A new organisation of the maintenance management has to be included.

Taking into account the dimension of the country, it is recommended to set up a central management split into three divisions. Each ot those divisions will be responsible of one maintenance level described in the Part 2 Chapter 3 of this report. The line inspection and the drivers (first level) have to be managed by the train operation department. One of those divisions will be in charge of running maintenance, a second one in charge of overhauls, a third one in charge of the maintenance and replacement of equipment and components. It will also be in charge of the spare parts procurement co-ordination. Special attention has to be paid to maintenance monitoring and failure follow up.

Each division will define the maintenance rules, the equipment upgrading and procurement and will be in charge of co-ordinating resource sharing between depots and workshops dealing with the same maintenance level and the same vehicle types.

Each depot and workshop will be organised in business unit.

Moreover, the Kazakh railway organisation is huge (more than 160,000 employees), and so wide restructuring cannot be implemented everywhere at the same time. Therefore, it is recommended to define the proposed organisation and, then, to test it in a pilot area, So adapted organisation will then be applied all over the country.

It should be pointed out that such restructuring is independent from the train operation restructuring and track infrastructures improvement which will allow to increase the train operation performances

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level. Due to the numerous depots and workshops distributed all over the country, a special care has to be borne in the implementation of a centralised information system which will collect data in each of the depots and workshops M. I. S.

USD 6 millions have to be allocated to the definition and to the test in a pilot area (first phase of restructuring).

USD 4 millions have to be allocated to the restructuring implementation in the workshops and depots which will be kept working (second phase of restructuring). See below the proposal for maintenance facilities.

Those fund allocations include consulting services, logistics and computers to be installed in the maintenance facilities.

5.2 Rolling stock

5.2.1 Locomotives

To deal with the current situation, 1,300 locomotives are required : 550 main line diesel, 350 main line electric and 400 shunting.

2,350 are available : 1,210 main line diesel, 650 main line electric and 490 shunting.

Moreover, their average age is less than 15 years old, therefore, the required locomotives can be chosen among the youngest ones. It is recommended to rid of the excess locomotives.

Improvements of train operation performances could allow to reduce even more the fleet to .

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to .

Thus, no investment for new locomotives procurement is required over the 10 next years.

A test is currently perlormed for replacement of existing diesel engines with new ones from a western technology. The results of such a test have to be analysed thoroughly. Other modifications and tests have also to be carried out in order to improve the efficiency of the diesel engines and to increase their maintenability (they are presently removed every 7 years for overhaul).

USD 15 millions have to be allocated for diesel engine improvements.

5.2.2 Passenger coaches

Studies are presently performed to build a passenger coach construction plant in Kazakhstan. Prior to conclude any agreement for such a plant, it is highly recommended to analyse the passenger traffic demand, to adapt the passenger services to the demand and then to design new passenger coaches accordingly. Inter-city trains are likely to be necessary.

For the time being, all the available fleet is required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches will appear is the next years, the existing ones will be needed during at least 10 to 15 years for long distance services, which will remain numerous in Kazakhstan. Rehabilitation and modifications have to be carried out in those existing ones.

USD 50,000 have to be allocated to each of the 2000 coaches during the 10 next years.

5.2.3 Wagons

The fleet of existing wagons (100,000) is large enough to cover the current needs (55,000). Improvements of operation performances and increase of traffic will require to maintain available such a fleet.

In particular, the tank wagons are rapidly deteriorating and the current fleet will have to be increased within 5 to 10 years. Some studies are carried out to bulld new tank wagons from useless flat wagons.

USD 20,000 have to be allocated for refurbishment of each of 1000 wagons or procurement of new ones

5.3 Maintenance facilities

5.3.1 Locomotive maintenance facilities

The 42 depots are not necessary to maintain the 1,300 locomotives required to deal with the current situation. Therefore, it is recommended to improve the conditions of some of them and to close down the other ones.

It is proposed to keep working the 13 following depots :

- for electric locomotives : Tselinograd, Atbasar, Ekibastuz and Karaganda ; Atbasar will be dedicated to TR3 operations
- for diesel locomotives : Djanbul, Pavlodar, Almaty, Zashita, Aktubinsk, Makat, Uralsk, Saksaulskaya and Kushmurun ; Djanbul and Pavlodar will be dedicated to TR3 of main line diesel locomotives and Kushmurun will be dedicated to TR3 of shunting locomotives.

The depots are generally in good conditions, hawever, machinery overhauls, cleaning, building improvements have to be carried out. Furthermore, the best machine tools and workshop equipment of the depots which will be closed have to replace the oldest machine tools and equipment of the depots which will be kept working.

USD 1 million have to be allocated to the improvement of each of the remaining depots.

Moreover, it is recommended to develope the former projects of overhaul workshop implementation in Borovoye and Kazalinsk.

USD 30 millions have to be allocated to each of them.

5.3.2 Coach maintenance facilities

The 3 depots should be kept as they are.

Almaty workshop has to be upgraded to deal with overhaul of the passenger coaches of the Central Asia countries. In order to improve the quality and to reduce the maintenance costs, restructuring has to be studied and original spare parts of highest quality have to be purchased.

USD 5 millions have to be allocated for improvements of the overhaul workshop

Moreover, a modern paint shop is required for the whole TRACECA region.

USD 10 millions have to be allocated for the implementation of such a paint shop.

5.3.3 Wagons maintenance facilities

In order to carry out the running maintenance of the 57,000 wagons required to deal with the current situation, 8 of the 21 depots are necessary. Therefore, it is recommended to keep working the following running maintenance depots :

Atbasar, Ekibastuz 1, Karaganda, Zatshita, Pavlodar, Djambul, Chelkar, Kyzyll Orda, Borovoye. Chelkar depot has to be refurbished, its capacity has to be increased to 4000 TR / year.

USD 2 millions have to be allocated for Chelkar depot refurbishment.

Furthermore, such a wagon fleet requires facilities for overhaul and only one is operating. Since, the following depots need refurbishment. It is proposed to restructure those depots in overhaul workshops :

- Akmola : opened wagon, it is already working
- Uralsk : tank wagons
- Kazalinsk : hoppers and containers
- Atyrau : special wagons.

USD 5 millions have to be allocated for each of the 3 workshop to be re-organised.

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph includes an efficient spare parts management system. However, it needs several years to be implemented and the railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 50 millions have to be allocated to the urgent needs of spare parts.

5.5 Manufacturing

5.5.1 Local spare parts manufacturing

An agreement was signed in May 1996 between Uzbekistan, Kyrghyzstan and Kazakhstan to establish co-operation for local manufacturing of spare parts. It is recommended to enlarge such an agreement to other countries and to implement the agreement.

The Part 2 Chapter 3 of this report proposes a working plan for such implementation. The components and the quantity to be produced have to be thoroughly analysed. The distributionn of the plants has to be negotiate between those countries.

USD 1 million have to be allocated to assist such initiative.

5.5.2 Construction plant for passenger coaches

Plans have been made and negotiations are in progress to implement a construction plant for passenger coaches. Such plans have to be encouraged, however, it has to be reminded that, prior to design a new plant, analysis of passenger traffic demand has to be performed so as to define thoroughly the type and the number of passenger coaches to be manufactured.

A rough estimate of the quantity of passenger coaches for the TRACECA region, based on the current requirement is 4,000 coaches. Taking into consideration a renewal of 10% per year from 2005, the required production should be 400 coaches per year.

USD 50 millions have to be allocated for such a plant.

5.6 Investment plan for the next 10 years

Investment - USD million	Period 1995-2000	Period 2000-2005
Urgent needs of sparre parts	50	
Restructuring - M I S system	6	4
Locomotives	15	
Passenger coaches	50	50
Wagons	10	10
Maintenance facilities for locomotives	13	90
Maintenance facilities for passenger coaches	15	
Maintenance facilities for wagons	2	15
Manufacturing	1	50
Total	**162**	**219**

KYRGHYZSTAN Railways

Table of contents

1. Overall

1.1 Infrastructures

The network is 424 km long, only single track, 323 km in the Northern part of Kyrghyzstan and 101 km in the Southern part. The track gauge is 1520 mm and the average distance between two stations is 15 km. No information are available concerning profile. There is no tunnel. They have 148 bridges (two of metal and the rest cement/blocks/stones).

20 km of the main lines are whole-welded on concrete sleepers and the rest are bolted joints (25 m) on wood sleepers

Minimum curve radius 300 m

Maximum slope and length:

- North 20%
- South 37%
- Length about 10 km

Signal system:

The line between Bishkek and Balakti is fitted with automatic block controls the rest of the lines are fitted with half automatic blocks. All stations are electrical controlled except five which are manual controlled. They have radio communication between their locomotives and the stations.

1.2 Management organisation

Kyrghyzstan railways is divided into two geographical regions without direct rail connection inside Kyrghyzstan :

- 1. North, the line from Kazakhstan border to Balakti
- 2. South, Osh - Djalal Abad

1.3 Traffic

1.3.1 Freight traffic

Due to the geographical position of Kyrghyzstan, all the freight exported and imported feed the TRACECA corridor, either through Kazakhstan by the northern line or through Uzbekistan through the southern line. Consequently, there is no transit traffic in Kyrghyzstan.

According to TRACECA Regional Traffic Forecasting Model project :

- the freight exported reached 765,000 t in 1995, among them 37% are minerals (mainly coal), 18% are vegetal products and 13% are non precious minerals ;

- the freight imported reached 1,700,000 t in 1995, among them 38% are minerals (mainly oil products) and 32% are chemical product.

Moreover, it was reported that :

- 90% of the freight traffic are import and export ;

- the freight transported by rail in 1995, represents 404 million ton.km and 2.53 mln t.

Therefore, the average distance of good transport is 160 km.

Quantity of freight transported in 1995

Type	1000 ton
Grain and bread products	233
Coal	932
Oil and oil products	862
Black metal	71
Wood	43
Chemicals	32
Construction materials	149
Cement	187
Cotton and other things	18

1.3.2 Passenger traffic

1.3.2.1 Current traffic

The railways have realised 87 mln passenger.km in 1995, among that turnover, 20% are domestic patronage. Taking into account the central position of Bishkek on the northern line, and the maximum length of the line, the average trip is assumed to be 150 km.

Therefore, the ridership in 1995 is evaluated at 580 000 passengers.

1.4 Train operation

Characteristics

As most of the freight services in the area, the average speed between two terminal stations (except loading and unloading times), is about 30 km/h for freight trains and 35 km/h for passenger trains.

The operation of the Kyrghyz railways is extremely tied to neighbour countries, Kazakhstan and Uzbekistan. Freight and passenger operation performances depend on the co-ordination with those countries.

The southern line is partly operated by the Uzbek railways, such agreement is highly recommended, the Kyrghyz railways own the infrastructures, and they should keep control on it. However, since Uzbek railways are operating and maintaining the Fergana valley railroad, they could maintain the infrastructures and operate most of the international services within the border of Kyrghyzstan .

Railroad links between Osh region and northern region is constituted by a loop of 1400 km through Tashkent. By car, the distance to cover is only 400 km but, through an elevated pass.

Therefore, even though the railroad loop is time consuming and costly, it would remain the only alternative for bulk traffic, mainly during winter season. However, the passenger services require 36 hours to cover the distance. Those services are not able to compete against road services. Instead of this link, it would be more efficient to negotiate joint services with Uzbek railways and to set up transfer in some cities.

Temporary storing of freight is not on the responsibility of the Kyrghyzstan Railways but of the customers who are not always very keen to quickly release the wagons.

Loading of 20-feet containers is possible on four stations.

Average number of train in operation per day:

- passenger 7
- freight 3

Railway education system:

They have a education system within the railway for all their specialists. Education on a high level they have to use Almaty or the Technical Institute in Bishkek.

Economical results of operation (1995 mil som)

	Passenger	Freight	Total
Income	59,4	98,4	157,8
costs	87,7	52,8	140,5
Total	-28,3	45,6	17,3

Failures in operation

In 1995 they had 43 derailments

2. Rolling stock

2.1 Locomotives

Type of service	Type of locomotive	Quantity of locomotives	Quantity of units
Long distance	3TE10M	3	9
	2TE10L	11	22
	2TE10V	17	34
	2TE10M	3	6
Total		34	71
Shunting	TEM2	14	14
	ChME3	9	9
Total		23	23
Total		**57**	**94**

Age of the fleet

Type	Quantity	Year of construction
3TE10M	3	1983
2TE10L	11	1970-1976
2TE10V	17	1977-1980
2TE10M	3	1981-1982
TEM2	14	1969-1986
ChME3	9	1988-1990
Total	57	

No locomotives are out of order, but 70% of the locomotives are over-ran (maintenance km).

Locomotives have been scrapped and spare parts have been used to keep the existing fleet in operation.

2.2 Passenger coaches

There are two main types of wagons, sitting and sleeping wagons. The origin of sleeping wagons is Germany (Amendorff) and sitting wagons Russia (Tver).

There are about 79 wagons out of order due to their age (more than 28 years). They have just scrapped 21 wagons to get some spare parts and planned to scrap 40 other coaches

Age of the passenger coaches.

Year	SV	TSMK	TSMO	MObl	P/V	VR	Other	Total	%
1950-59							1	1	0 %
1960-69		39	18	16	9	8	3	93	17 %
1970-79		49	153		11	9	1	223	42 %
1980-89	9	46	110			12		177	34 %
1990-95		18	15			2		35	7 %
Total	9	152	296	16	20	31	5	529	100 %

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2.3 Freight wagons

Amount of wagons and their age:

Type	19??-1969	1970-79	1980-89	1990-95	Total
KR, closed	182	296	180	24	682
PL, platform	101	225	135	18	479
PV, open	93	276	275	44	688
TsS, tank	69	91	85	6	251
Other, mixed	80	99	306	31	516
Total	525	987	981	123	2,616

« Other » included : 58 container wagons (average age 26 years).

727 wagons are out of order since they are not needed to deal with the present freight volume.

3. Maintenance

3.1 General management

Each workshop has its own bank account and the manager of the workshop is responsible for the account (budget and legal use) to the Railway Managing Director.

Changes of technical rules concerning maintenance of the rolling stock can only be done by the Ministry of Transport.

Each workshop has its own follow-up system on production and budget. They draw up quarterly reports to the railway management.

Reports from current staff in operation are forwarded to the respective workshop management for further treatment.

3.2 Maintenance facilities

3.2.1 Locomotives maintenance facilities

Locomotives Depots for running maintenance	Year of construct improvt	Number of bays	Capacity TO3,TR1 ,2 / year	Comments
Bishkek				Able to carry out up to TR-2 maintenance
Jalal Abad				TO2 and minior repairs for shunting locomotives

3.2.2 Wagon maintenance facilities

Wagons Depots for running maintenance	Year of construct improvt	Number of bays	Capacity TR / year	Comments
Bishkek			400	DR and repairs Opened air depot
Belovodskoe	1997		1000	Construction in progress
Kant				TO and minor repairs
Osh				TO and minor repairs
Jalal Abad				TO and minor repairs
Workshop for overhaul maintenance	Year of construct improvt	Number of bays	Capacity KR / year	Comments
Belovodskoe	1997		100	Construction in progress

TO-1 and TO-2 inspection are carried out on all freight loading stations of which are 25 in Kyrghyzstan. If failures cannot be repaired locally, the wagon is transferred to Bishkek (workshop), Kant, Jalal Adad or Osh (depots). Refrigerator wagons are maintained by the passenger wagon department. All cleanliness of freight wagons has to be done in Bishkek.

Major repairs and TR-1, DR and KR-2 maintenance have to be carried out in the main workshop in Bishkek.

The capacity in Kyrghyzstan is 2000 current maintenance per year and 400 wagons per year for main maintenance (TR-1, DR and KR-2). About 400 workers are employed in the workshop.

In 1995 they carried out repair on 1050 wagons and 24 main maintenance.

The Belovodskoe workshop is under construction in an old disused plant. It will replace the Bishkek depot which is in open air and in very poor condition. Capacity of the new workshop is planned to be 1000 wagons for current maintenance and 100 wagons for main maintenance per year.

A centralised information system collects data on wagon condition and maintenance.

3.2.3 Passenger coaches maintenance facilities

Passenger coaches Depots for running maintenance	Year of construct improvt	Number of bays	Capacity DR / year	Comments
Bishkek				up to DR and KR1 maintenance
Osh & Jalal Abad				TO and minor repairs

The workshop in Bishkek is divided into 3 parts :

- Central workshop, all maintenance
- Assembling place
- Old agriculture machinery plant for roof and electrical repair

There are employed 2157 workers in the passenger coach department.

A paint workshop for passenger wagons is under construction and widening of the passenger wagons repair shop is on the way in order to increase its capacity up to 480 wagons per year.

The centralised information system for wagons is also used for passenger coaches.

The Bishkek workshop is also responsible for the maintenance of 24 refrigerator wagons.

Production

Type of inspection	period	planned production 1996	Realised 1. Quarter 1996	estimated costs (sum)
TO-1	before operation			726/wagon
TO-2	summer/winter			
TO-3	6 months	13,300	3,311	9,655,800
DR	1 year			
KR-1	5 years	320	80	6,280,960
KR-2	20 years	10	3	8,750,000

All unexpected repairs are included in the above mentioned figures.

Due to lack of spare parts they can not complete their planned maintenance program. They have to operate with wagons over-ran.

The railways plan to :

- Carry out passenger coach rehabilitation (KVR) for 15 coaches in Almaty, for an unit cost of DM 350,000 (+20% VAT) and 30 wagons in Poland for an unit cost of USD 225,000. The contract with Poland includes "change of components".
- Modify wagon type from TSMO to MObl in Almaty, for an unit cost of Som 875,000 (USD 90,000).

3.3 Spare part management

The railway management is negotiation a contract with former suppliers in Russia, based on "change services". Local enterprises can co-ordinate arrangements of spare parts with foreign suppliers.

30% of the total budget is allocated for spare parts and material procurement (25% abroad and 5% local).

1995 material costs (1000 som)

Type	Locomotives	Freight wagons	Pass. wagons	Track maint.	Total
Fuel	16,627	94	1,860	685	19266
El. energy	140	74	203	159	576
Spare parts	3,104	1,515	11,196	1,216	17,031
Sleepers, rail	-	-	-	3,742	3,742
Total	19,871	1,683	13,259	5,802	40,615

Brake blocks and rubber components can be produced locally.

Less than 1% of the needed spare parts can be purchased locally.

The main spare parts needed are : wheels, couplers, bogies, parts to the brake system, gear boxes, absorbers, electrical equipment (generators, relays, batteries etc.), diesel motor (pistons and cranks), bearings for pistons and wood.

4. Future requirement evaluation

4.1 Assumptions

4.1.1 Traffic forecast for the next 10 years

year		1995	%	2000	2005
Passenger turnover	**th pass.km**	**87 000**		**87 000**	**87 000**
Total ridership	**th pass**	**580**		**580**	**580**
Turnover	**th t.km**	**402 600**		**402 600**	**443 000**
Total freight	**th t**	**2 527**		**2 527**	**2 780**
Imported by rail	th t	1 540	61%	1 540	1 695
Exported by rail	th t	700	28	700	770
Domestic traffic	th t	287	11%	287	316
Breakdown of freight per product					
Grain	th t	233	9%	233	256
Coal	th t	932	37%	932	1 025
Oil and oil products	th t	862	34%	862	949
Black metal	th t	71	3%	71	78
Wood	th t	43	2%	43	47
Chemicals	th t	32	1%	32	35
Construction materials	th t	149	6%	149	164
Cement	th t	187	7%	187	206
Cotton and other things	th t	18	1%	18	20
TOTAL		2 527	100%	2 527	2 780

4.1.2 Evaluation of operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	8	8	14	14	18
Annual average distance run	km	31 000	76 600	182 000	182 000	350 000
Freight trains						
Average speed	km/h	30	30	40	40	50
Average train load	t	2000	2000	2000	2000	2000
Average wagon load	t	30	30	30	30	30
Wagon turn around	days	7	7	5	5	5
Annual distance run per wagon within Kyrghyzstan	km	8 500	12 000	17 000	17 000	17 000
Passenger trains						
Average speed	km/h	35	35	50	50	90
Average train ridership	pass	120	120	180	180	180
Average coach per train		10	10	6	6	6
Annual distance run per coach	km	13 700	66 000	70 000	70 000	170 000

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	34	14	4	4	2
Freight trains		5	2	2	1
Passenger trains		9	2	2	1
Shunting locomotives	23	12	12	12	10
Passenger coaches	529	110	41	31	17
Wagons - total	2 616	1 880	1 345	1 480	1 480
Open - PV	688	753	538	592	592
Tank - TS	251	659	471	518	518
Covered - KR	682	188	135	148	148
Platform - PL	479	132	94	104	104
Others	516	151	108	118	118

4.3 Maintenance facilities requirements

4.3.1 Locomotive maintenance facilities

Main line locomotives	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel main lines locomotives	71	29	9	10	2
Annual run of a locomotive km	31 191	76 601	182 868	181 910	346 532
Running inspection					
Production of TO3 / TR1	1 420	578	187	196	10
Production of TR2	47	19	6	6	2
Production of TR3	23	10	3	3	1
Overhaul					
Production of KR	14	6	2	2	

Shunting locomotives	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	23	12	12	10	10
Running inspection					
Production of TO3 / TR1	230	120	120	100	20
Production of TR2	9	5	5	4	3
Production of TR3	6	3	3	3	2
Overhaul					
Production of KR	3	2	2	1	2

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	529	110	41	31	17
Annual run of a passenger coach km	13 705	65 739	70 435	93 913	169 043
Running inspection					
Production of TO2	529	110	41	31	17
Production of TO3	529	110	41	31	
Overhaul					
Production of KR	106	22	8	6	3

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	2 616	2 047	1 462	1 609	1 609
Annual run of a wagon km	8 550	10 925	15 295	15 295	15 295
Running inspection					
Production of TR	2 616	2 047	1 462	1 609	1 609
Overhaul					
Production of KR	262	205	146	161	161

5. Recommendations

5.1 Management

For a TRACECA regional point of view, it is recommended that an independent entity operates and maintains the rolling stock for a larger network including part of Kazakh, Uzbek or Tadjik railways. Or, one of those railways reaches an agreement with the Kyrghyz railways to operate and maintain all or part of their railways.

These entities could be specialised by types of freight or passenger services.

A Management Information System has already been introduced in each depot and workshop. It is recommended to extend the current system to perform a comprehensive follow up of failures and spare parts consumption and repair.

Moreover, a central maintenance management is recommended to co-ordinate resources utilisation, and to facilitate workshop equipment sharing for all kinds of vehicles.

USD 1 million have to be allocated for such system extension and management restructuring.

5.2 Rolling stock

5.2.1 Locomotives

To deal with the current situation, 26 locomotives are required : 14 main line diesel and 12 shunting.

All are available : 34 main line diesel and 23 shunting.

Moreover, their average age is less than 15 years old, therefore, the required locomotives can be chosen among the youngest ones. It is recommended to rid of the excess locomotives.

Improvements of train operation performances could allow to reduce even more the fleet to 16.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 12.

Thus, no investment for new locomotives procurement is required over the 10 next years.

Using a new locomotive technology only 2 main line locomotives could be enough to cover the needs. Those locomotives would run 350 000 km per annum, which is in compliance with the efficiency expected with that new generation of rolling stock. Obviously, this alternative is not realistic in the case of an independent network. It is consistent if the 300 km of the northern network are operated by an independent entity which also operates a neighbour network. One of those 2 locomotives would be the fleet required to operate the Northern Kyrghyzstan line. The same analysis is valid for one locomotive in operation on the Southern line.

Moreover, to be easily integrated to a neighbour network, the infrastructures of Kyrghyzstan should be similar to the infrastructures of the neighbour network, in particular, if the Kyrghyz network is electrified.

Even though the locomotive fleet can cover the present requirements, overhaul maintenance has to be performed.

USD 200,000 have to be allocated for overhaul of each of 10 locomotives during the next 10 years.

5.2.2 Passenger coaches

For the time being, 110 coaches of the 530 coaches are required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches, such as inter city coaches, will appear is the next years, some of the existing ones will be needed during at least 10 to 15 years for long distance services.

Therefore, it is proposed to rehabilitate 50 of those coaches.

USD 200,000 have to be allocated to each of the 50 coaches during the 10 next years.

5.2.3 Wagons

The fleet of existing wagons (2,600) is large enough to cover the current needs (1,900). Improvements of operation performances could reduce that required fleet to 1,400 wagons.

However, tank wagons and open wagons are not in excess. Tank wagons are provided by the suppliers of oil product who import into Kyrghyzstan, therefore, the need is not urgent, but it could facilitate the freight management of the Kyrghyz railways. The same situation occurs concerning the open wagons, however, the improvement of operation performances could solve the lack of open wagons.

USD 20,000 have to be allocated for 200 tank wagon procurement or modification of other useless wagons to build tank wagons. The sales of useless wagons should reduce that investment. In particular, refrigerator wagons could be sold to Caucasus countries where some are missing.

5.3 Maintenance facilities

The workshops are functioning despite of old technology within some areas.

The logistics have to be upgraded, organisation and cleanliness improved, which will increase efficiency and productivity.

Bishkek workshop has to be improved.

Jalal Abad has to be restructured to be able to cope with running maintenance and small repairs of all kind of vehicles.

USD 3 millions have to be allocated to a new wheel shop in Belodovskoe and to new machinery.

USD 1 million have to be allocated for Bishkek workshop refurbishment.

USD 1 million have to be allocated for Jalal Abad workshop refurbishment

5.4 Spare parts procurement

The railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 2.5 millions have to be allocated to the urgent needs of spare parts.

5.5 Investment plan for the next 10 years

Investment	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	2.5	
Restructuring - M I S system	1	
Locomotives	1	1
Passenger coaches	5	5
Wagons	2	2
Running maintenance facilities- building	5	
Total	16.5	8

TADJIKISTAN Railways

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1. Overall

The Tadjk Railways emerged as an independent entity on October 1st 1994, having been under Russian management since 1929 when the Soviet Union engineers began building the network.

The network is laid on 423 km on single track of standard Russian gauge. It consists of three separated lines :

- The Northern Line, connected to the Uzbekistan network at both ends, goes from Nau in the east via Hujang to Kanibadam, length of the line : 110 km.
- The Central Line runs from Patahabad at the Uzbek border via Dushambe to Yangibazar, length of line : 93 km
- The Southern Line runs from Hashidy at the Uzbek border via Kurkan-Tube to Vash, length of line : 220 km

In order to go from the Central and Southern Lines to the Northern Line the trains have to pass through 700 km of the Uzbekistan and Turkmenistan railway networks.

The Tadjik railway network includes 29 stations.

Max. slope of the Tadjik railway tracks is 18 o/oo and there are no tunnels and no electrified lines.

Nos. of employees: approximately 7000

1995 traffics :

- 123.8 mill. passenger-km
- 2114.6 mill. tonnes-km

No figures were given for previous years, presumably because Tadjik railways were under Russian management.

2. Rolling stock

2.1 Locomotives

Main line locomotives	
• 2501 - 3000 HP	4
• 3000HP	42 (dual sets)
Shunting locomotives	21

Average age of the locomotives: 17 years
No. of locomotives in operation: 41

2.2 Passenger coaches

Ritz	18 seats	10
compartment	36 seats	2
Plats cart	54 seats	139
Closed compartment	36 seats	177
Restaurant car		14
Opened compartment	84 seats	8
Luggage		1
Staff		4
Total		**355**

No. of coaches in operation : N/A

Age distribution of coaches : N/A

Average age of coaches: 22 years

All windows are fitted with grids as protection against rebel attacks

2.3 Freight wagons

Covered	557
Platform	334
Open	619
Tank	21
Refrigerator wagons	208
Special	581
Total	**2.320**

Number of wagons in operation N/A
Age distribution of wagons N/A
Average age of wagons 16 years

3. Maintenance of rolling stock

3.1 General observations

Due to lack of spare parts the vehicles out of service are cannibalised

The work force seems to have good skills. But it was reported that over one million people left the country after the Former Soviet Union break-up, most of them with high skill. As an example, the machine shop of the passenger depot is idle due to lack of fitters.

Important data such as MTBF are not available and nobody could give the lifetime of wheels or how many hot boxes are reported per year.

It was not possible to identify any local industries which could assist Tadjik railways in the manufacturing of spare parts.

Tadjik railways tried to produce its own brake shoes, but it failed due to poor quality of the local raw material.

3.2 Locomotives maintenance facilities

Dushambe depot

The depot was originally built in 1929 in conjunction with the building administration. The depot was enlarged in 1966 and 1981.

The depot can accommodate 5 dual set locomotives and it includes repair shops for : bogies, bearings, brake valves, motors, batteries, machine tools.

Two old wheel lathes are in operation, but a brand-new Russian under floor wheel lathe was purchased to be installed in Hugand. In general the machinery and the lifting jacks are very old and some of the machine tools require a comprehensive overhaul.

Passenger coaches are also repaired in the depot.

Khodjent depot

Next to the passenger station, tracks from the station yard were dedicated to the running maintenance of the locomotives. No lifting jacks are available, no shed to cover the maintenance area. Worn equipment and components are laid along the locomotives under repair.

In order to be able to carry out proper locomotive maintenance in the northern area, a new depot is under construction.

The new building is fitted with two maintenance tracks long enough to accommodate 3 vehicles. The first track is fitted with pit and scaffoldings, the second one is fitted with lifting jacks and under floor wheel lathe.

3.3 Passenger coach maintenance facilities

Production

The Dushambe coach depot is presently the only one for coach running maintenance, but a new depot is planned in Hugand. It is designed for the maintenance of 1200 coaches per year in order to carry out the major overhauls of the coach fleets of all neighbouring countries.

Last year 16 KR1 were carried out in Ukraine.

Before summertime, major inspection are planned on air conditioning systems, but it was claimed that neither facilities nor equipment for the repair of the air conditioning systems are available.

Dushambe coach depot

The depot was commissioned in the early 1996.

The coaches are placed under a roof without any side wall. Several lifting jacks and a gantry crane are used to lift the vehicle and remove the bogies.

The wheel shop is fitted with an Ukrainian wheel lathe installed in 1995,

It was reported that the bogies are checked for cracks, but no facilities for bogie washing and no crack-detector were shown.

Bearings are cleaned and greased, but there are no measure equipment for the rollers.

In the machine shop seven tool machines (lathes, milling machines, radial drilling machines, and shapers) are installed, but it was said that for the time being there are no fitters available to operate the machines.

The machines are rather new (max. 8 years).

Equipment for check of shock absorbers are installed, but not in use due to lack of spare parts

In addition the following shops are in operation :

- Repair shop for the brake system including valves and brake regulators
- Battery charger and repair shop
- Welding shop for repair of couplers. This is the only place where a component for the entire fleet was repaired.
- Carpentry shop. Not in operation due to lack of wood.
- Blacksmith not in operation
- Next to workshop a coach washing machine cannot be operated due to lack of gas.
- A new Atlas Copco air compressor supplies the workshop.

3.4 Wagon maintenance facilities

Dushambe depot

The wagon depot in Dushambe has been set up in the former depot for passenger coaches.

The lay-out of the bogie maintenance shop, including wheel turning and bearing cleaning, is good and organised as a production line.

The two wheel lathes are fairly old, but one of them is in working condition.

The remaining shops are mainly :

- The machine tool shop with a standard set of machines : lathes, drilling machines, shapers etc.. All of them are in working condition, but fairly old.
- The brake valve shop in poor condition.

Makham depot

In the Northern area a new wagon workshop was reconstructed next to the old one. It is fitted with four tracks which can accommodate about 16 wagons. The bogie shop area is fitted with new gantry cranes, a bogie washing machine and a wheel lathe. The maintenance tracks are fitted with movable lifting jacks.

The old workshop is used for bogie crack checking and storage of spare parts.

The workshop manufactured small tank trolleys for agriculture, but the production has stopped due to lack of customers.

A new shop is under construction for passenger coach maintenance.

3.5 Summary of maintenance facilities

Locomotives Depots for running maintenance	Year of construct improvt	Number of bays	Capacity TO3,TR1 ,TR2/ year	Comments
Dushambe	1929 / 66 / 81	10		Require a comprehensive overhaul
Hugand (Leninabad-Khojent)	96	6		under construction
Passenger coaches Depots for running maintenance	Year of construct improvt	Number of bays	Capacity DR / year	Comments
Dushambe	96			Good working conditions
Wagons Depots for running maintenance	Year of construct improvt	Number of bays	Capacity TR / year	Comments
Dushambe				Required overhaul
Makham	1996	16	850	Brand new, well designed

4. Future requirement evaluation

4.1 Assumptions

4.1.1 Traffic forecast for the next 10 years

The TRACECA Regional Traffic Forecasting Model reports that 1,390,000 t were imported and 590,000 t were imported in 1995. Taking into account that, in the neighbour countries 95% of import and export are realised by rail, and few of the freight is domestic, it is assumed that a load of 2,000,000 t were transported by rail in 1995. The transit traffic in the Northern line is not included. Based on an average distance run by the freight of 300 km, the freight turnover should have reached 600 million tons in 1995.

year		1995	%	2000	2005
Passenger turnover	th pass.km	123,800		123,800	123,800
Total ridership	th pass	825		825	825
Freight turnover	th t.km	600,000		600,000	660,000
Total freight	th t	2,000		2,000	2,200

4.1.2 Evaluation of operation performances

Operation performances		Existing situation	Short term		Long term	
			Alter 0	Alter 1	Alter 1	Alter 2
Locomotives						
Average daily running time	hr	8	8	10	14	18
Annual average distance run	km	30,986	76,479	134,338	191,523	246,244
Freight trains						
Average speed	km/h	30	30	40	40	40
Average train load	t	2,000	2,000	2,000	2,000	2,000
Average wagon load	t	50	50	50	50	50
Wagon turn around	days	15	15	5	6	6
Annual distance run per wagon	km	10,345	11,520	28,800	24,000	24,000
Passenger trains						
Average speed	km/h	35	35	50	50	50
Average train ridership	pass	150	100	100	60	60
Average coach per train		15	10	10	6	6
Annual distance run per coach	km	34,873	65,739	93,913	93,913	93,913

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	46	24	13	14	11
Freight trains		9	4	3	3
Passenger trains		15	9	10	8
Shunting locomotives	21	15	15	12	12
Passenger coaches	355	188	132	132	132
Wagons - total	2,320	2,083	694	917	917
Open - PV	619	556	185	245	245
Tank - TS	21	19	6	8	8
Covered - KR	557	500	167	220	220
Refrigerator - XX	208	187	62	82	82
Platform - PL	334	300	100	132	132
Hopper - ZR					
Others	581	522	174	230	230

4.3 Maintenance facilities requirements

Main line locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel main line units	88	46	25	26	11
Annual run of a locomotive km	30,986	76,479	134,338	191,523	246,244
Running inspection					
Production of TO3 / TR1	1,760	920	495	522	42
Production of TR2	58	30	16	17	7
Production of TR3	29	15	8	9	4
Overhaul					
Production of KR	18	9	5	5	2

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	21	15	15	12	12
Running inspection					
Production of TO3 / TR1	210	150	150	120	24
Production of TR2	18	6	6	5	4
Production of TR3	5	4	4	3	2
Overhaul					
Production of KR	3	2	2	2	2

Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	355	188	132	132	132
Annual run of a passenger coach km	34,873	65,739	93,913	93,913	93,913
Running inspection					
Production of TO2	355	188	132	132	132
Production of TO3	355	188	132	132	
Overhaul					
Production of KR	71	38	26	26	26

Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	2,320	2,083	694	917	917
Annual run of a wagon km	10,345	11,520	28,800	24,000	24,000
Running inspection					
Production of TR	2,320	2,083	694	917	917
Overhaul					
Production of KR	232	208	69	92	92

5. Recommendations

5.1 Management

Maintenance management

As long as the Tadjik railways operate themselves the 100 km long North line, they need maintenance facilities to carry out repairs and running maintenance. The new Makham and Khodjent depots are well designed for that purpose. However, the Northern line traffic is mainly a transit traffic of Uzbek railway, therefore, it is recommended to allow Uzbek railways to operate their own locomotive through the Northern Tadjik line. Both organisations would save time and money. Doing so, the Tadjik locomotive needs will be reduced.

M.I.S. and maintenance organisation restructuring

An efficient management maintenance system has to be implemented.

Moreover, it is recommended to restructure the maintenance management so as to set up :

Business units in Dushambe and Hugand, each of them in charge of the running maintenance of the whole fleet of rolling stock of their area. Such business units will be able to manage all maintenance facilities of their area and share staff, equipment, and facilities. The central administration will negotiate overhaul of all kind of vehicles with foreign plants.

USD 1 million is to be allocated for consulting services, computers and logistics

5.2 Rolling stock

To deal with the current situation, 40 locomotives are required : 25 main line diesel and 15 shunting.

67 are available : 46 main line diesel and 21 shunting.

Improvements of train operation performances could allow to reduce even more the fleet to 14.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 11 .

Therefore, no investment are required for new locomotives within the next 10 years.

For the time being, 200 of the 350 passenger coaches are required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches, such as inter city coaches, will appear is the next years, 100 of the existing ones will be needed during at least 10 to 15 years for long distance services. Rehabilitation and modifications have to be carried out in those existing ones.

USD 100,000 have to be allocated for refurbishment to each of the 100 coaches during the 10 next years.

The fleet of existing wagons (2,300) is large enough to cover the current needs (2,000). Improvements of operation performances and increase of traffic will require to maintain available such a fleet 1,000.

5.3 Maintenance facilities

Three depots should to be kept in Tadjikistan :

- one in Dushambe dealing with maintenance of locomotives, passenger coaches and wagons
- one in Hugand dealing with running maintenance of locomotives
- one in Hugand dealing with running maintenance of wagons and passenger coaches

USD 5 millions are to be allocated for facilities upgrading and completing construction of the other ones

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph will include a relevant spare parts management system. However, the railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 3 millions have to be allocated for the urgent needs of spare parts.

5.5 Investment plan for the next 10 years

Investment - USD million	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	3	
Restructuring - M I S system	1	
Passenger coaches	5	5
Maintenance facilities	5	
Total	14	5

TURKMENISTAN Railways

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1. Overall

1.1 Turkmenistan railways

Operation of the Turkmenistan Railways (TDDY) started at the end of the previous century.

The total length of the network is 2,198 km of the standard Russian gauge of 1520 mm.

All the network is single track, most of the rails being R-65 type.

Max. slope is 9 o/oo with a length of 300 to 350 metres.

There are two tunnels of 800 to 900 m long.

Average distance between stations is 17-18 km.

No lines are electrified.

Maximum speed is 90 to 100 km/h, but due to a rapid deterioration of the tracks a lot of sections have speed limits at 40 and 60 km/h.

The railway network consists of the following lines :

The main line linking Krasnavodsk (Turkmenbashii)-Ashgabad-Mary- Chardjev.

The other lines are :

- a link with the Afghanistan border (Mary to Gyshgy)
- a link with Kazakhstan and Russia (Chardjev-Darganata-Gazodjak-Dashhaouz), part of the line goes through Uzbekistan
- a link with Uzbekistan (Chardjev-Feder)
- a link from Uzbekistan to Tadjikistan crossing Turkmenistan
- a link to Iran (Tedjen-Mashkhad) ; the line was inaugurated on May 13, 1996, although the Iranian track uses a different gauge, it is a direct line to the Persian Gulf.

1.2 Transport and Communication Institute

The TDDY has its own Railway College where fitters, locomotive drivers etc. are trained.

The Transport and Communication Institute was built three years ago.

It covers more than 20 areas of training within transportation, goods handling and communications.

At present there are 1400 students at the institute, 140 full time teachers and 300 part time teachers.

There are presently 250 students trained for the railways as rolling stock engineers, permanent way engineers, goods handling, signalling and communications and transport economics. Some training are done in English. It was reported that 30 students could speak English.

The students have access to personal computers, donated by a Turkish company and Alcatel has donated a signalling system for training purpose.

The library contains more 100,000 volumes and the Ministry of Transport has recently spent USD 50,000 for the purchase of additional 3,000 books.

The students graduate after four years having spent some of the time on practical jobs at the railways.

All the students are from Turkmenistan, but it is not excluded that foreign students could attend the training at a later stage.

There is a close contact with the Russian Transport Institute to ensure an up-dated curriculum.

1.3 Traffics

1.3.1 Freight traffic

In 1990 the freight traffic reached a peak of approximately 55 bn ton-km.

In 1994 the yearly hauled freight dropped to less than 50% (23.1 bn ton-km) of the 1990 traffic.

The freight turnover for 1995 was : **8.568 bn ton-km.** with the following breakdown of loads :

	Domestic	International	Transit	Total
Oil	2,472	644	864	3,980
Building materials	4,165	590	707	5,462
Agricultural goods	11	13	33	57
Cotton	146	175	572	893
Other	777	5,215	5,780	11,772
Total	7,571	6,637	7,956	22,164

1.3.2 Passenger traffic

The yearly traffic was estimated to 6 million passenger.

It was reported that 14 passenger trains are running per day carrying 17,000 passengers.

At the Ashgabad Central Railway Station it was noted that eight trains were leaving and eight trains were arriving every day according to the time table.

In early 1996, a ticket from Ashgabad to Krasnavodsk (500 km) costs 6,700 manats or around USD 2.00

Mainly due to a very restricted tariff policy the yearly traffic volume has been fairly stable throughout the past years at around 2.0 to 2.2 billion passenger-km.

The average distance of a passenger is 340 km corresponding to a fare of 2,500 Manats or the equivalent of USD 0.8

In 1995 the transport of passengers dropped to: **1.876 bn passenger-km.**

Passenger turnover for the previous years was :

- 1993 : 2.200 bn passenger-km
- 1992 : 2.000 --"--"--
- 1991 : N/A
- 1990 : N/A
- 1985 : 1.700 bn passenger-km
- 1989 : 1.600 bn passenger-km

It was not possible to obtain any information of traffic costs and revenues.

2. Rolling stock

2.1 Locomotives

2.1.1 Main line locomotives

BUILT - YEAR	2T3 10A	2T3 10B	2T3 10M	2T3 10Y	NOS.
1969	4				4
1970	38				38
1971	56				56
1972	13.5				13.5
1973	38.5				38.8
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	182	4	14	33	233

Among the 233 locomotives only 120 are available for traffic.

It was not possible to obtain any data on which locomotives are out of traffic and for what reason.

The locomotives are operated in dual sets even on passenger trains which normally pull 16 coaches.

2.1.2 Shunting locomotives

BUILT - YEAR	T3M2	4M33	NOS
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 are in operation.

It was not possible to obtain any data on which shunting locomotives are out of traffic and for what reason.

2.2 Passenger coaches

Fleet:

Type	**No. of vehicles**
I Class	
Ritz 18 seats and sleeper	7
Sleeping cars 18 seats	8
Mixed 18 seats	9
II Class	
Two-level 54 seats	154
Half compartment	147
Inter regional 63 seats	38
Restaurant cars	17
Luggage	7
Special	4
Diesel electric van	2
Technical	8
Total	**401**

270 to 280 coaches are available for traffic.

It was not possible to get exact data on which types of coaches are available, but the « mixed » coaches, the restaurant and buffet cars have been withdrawn from service.

2.3 Freight wagons

Fleet:

Type	No. of vehicles
Covered	2,856
Platform	3,253
High sided open	2,118
Tank wagons	2,753
Cement	248
Container flats	257
Wheat silo	476
Refrigerators	700
Others	173
Total	**12,814**

Except for the tank wagons, which are manufactured in Ukraine, the remaining were manufactured in Russia.

In addition, other ministries own 2,328 wagons including 1184 tank wagons.

3. Maintenance

3.1 General observations

Each type of vehicle has its own maintenance organisation with the inherent facilities.

Only very little cooperation seems to take place between locomotives depots and passenger coach depots.

Typically each of the depot has its own wheel lathe, bearing shop, workshop for component repairs and spare parts which in fact are more ore less identical.

This is, of course a very expensive way to maintain a fleet, and in addition the same specialists are spread over three workshops (e.g. brake system, electrical equipment specialists).

It should also be mentioned that little care is borne in the protection of the environment i.e. no collection or waste lube oil, no cleaning of welding gas fumes or diesel engine exhausts etc. and in the depots no personal protection gear (Hard hats, hearing protection, or safety shoes).

Former Soviet Union trains had a high reputation of reliability, which proves an efficient preventive maintenance, but without any data on MTBF and a detailed knowledge of the quality of the various components it is difficult to judge whether the maintenance procedures lead to over-maintenance.

The maintenance and repair of the rolling stock by "cannibalising" can presumably continue for a short period of time, but the fleet is going to be deteriorated rapidly without having new spare parts to replace defective components. Overhauls must take place before it is too late or too costly to renew the fleet.

Moreover, machinery and other equipment suffer also from the lack of spare parts and maintenance, therefore a large part of the machine park needs replacements.

Maintenance staff

At present there are 6,864 employed at the maintenance organisation

- Loco maintenance :3351 employees
- Passenger coaches : 1781 employees
- Freight wagons : 1372 employees

Breakdown of staff

	Loco drivers	Ass. loco drivers	Loco maintenance staff	Fitters	Others	Total
ASHGABAD Major over-haul	130	69	186	37	400	822
Running depots			16			16
CHARDJEV Two depots	251	221	587			1,059
MARI depot	190	130	439			759
GAZADJIK depot	89	74	110	23	200	496
KRASNAVODSK depot	22	15	35	14	82	168
TOTAL	**682**	**509**	**1,373**	**74**	**682**	**3,320**

The working force seems to have fair skills and capable of doing small miracles to keep a fairly large part of the rolling stock in traffic.

Generally speaking the maintenance organisation is heavily over-staffed, but a considerable part of the staff seems to be semi-skilled workers.

Meanwhile the core of the staff will, no doubt, be capable of adapting new technologies and practically all the engineers seems to be very dedicated on their jobs.

3.2 Locomotive maintenance

3.2.1 Overall

Due to the difficulty to obtain spare parts from abroad, the preventive maintenance schedules have been changed from the original (Russian system). The locomotive overhaul periodicity have been extended for more than 80%.

The locomotive overhauls (KR) were carried out either in Ukraine or in Russia, but due to lack of foreign currency the last overhauls were carried out in 1993 and 33 locomotives were concerned.

The replacement of diesel engines after 600,000 km seems very short. The roller bearings also seem a weak point, requiring a lot of checking and maintenance.

Most of the spare parts required are taken from locomotives out of service.

In 1995 41.5 locomotives received a TR3 maintenance compared to 128 locomotives in 1992.

USD 61,830 were requested for a capital overhaul in Russia, but this price was considered as too high.

3.2.2 Locomotives maintenance facilities

Locomotives Depots for running maintenance	Year of construction or improvement	Number of bays	Capacity (TR per year)	Number of TR in 1995
Ashgabad depot		6 + 2	1300	4
Chardjev depot		12 + 2	1460	TE10/ChME3
Mary depot		6	1130	4
Workshop for overhaul maintenance : TR3	**Year of construction or improvement**	**Number of bays**	**Capacity (KR per year)**	**Number of KR in 199**
Ashgabad workshop	1934	6	200	TE10
Chardjev		12	70	ChME3
Gazandjik		1	30	ChME3

3.2.3 Ashgabad overhaul workshop

The main shop is fitting with several lifting jacks and a bogie conveyor

The back shops are mainly constituted of :

- Plast moulding shop. The moulds and the equipment were all made locally at the workshop.
- Repair shops for bearings, cylinders and motors. Renewal of the bearing metal are carried out here.
- A standard machine shop is fitted with traditional lathes, milling machines etc. The machine are old but, many of the lathes are working.
- A wheel shop fitted with :
  - Two wheel lathes (one very old and beyond repair) and a 15 years old Polish wheel lathe in good working condition, capable of turning about six new wheels per day.
  - Vertical lathe for wheel tires
  - Gas heater for tire assembly and a very old rolling machine.

3.3 Coach maintenance

As for the rest of the fleet the main concern was lack of spare parts, in particular spares for the electrical system, the air conditioning and the brake system.

Coach Maintenance Facilities

- Ashgabad
- Chardjev

The Ahsgabad passenger coach depot is located close to the locomotive depot.

The running maintenance depot in Ashgabad is fitted with one track which can accommodate two coaches. Two sets of lifting jacks allow to remove the bogies. A gantry crane allow to move heavy equipment.

3.4 Wagon maintenance

Depots for running maintenance	**Year of construction or improvement**	**Number of bays**	**Capacity (TR per year)**	**Number of TR in 1995**
Krasnavodsk depot				
Chardjev depot				
Enjev				
Mary depot				
Workshop for overhaul maintenance : KR	**Year of construction or improvement**	**Number of bays**	**Capacity (KR per year)**	**Number of KR in 199**
Kisilavatj				

4. Future requirement evaluation

4.1 Assumptions

4.1.1 Traffic forecast for the next 10 years

year		1995	%	2000	2005
Passenger turnover	**th pass.km**	**1,876,000**		**1,876,000**	**1,876,000**
Total ridership	**th pass**	**6,253**		**6,253**	**6,253**
Freight turnover	**th t.km**	**8,566,000**		**8,566,000**	**9,422,000**
Total freight	**th t**	**22,164**	**100 %**	**22,164**	**24,390**
Imported by rail	th t	3,650	16 %	3,650	4,020
Exported by rail	th t	2,990	14 %	2,990	3,290
Domestic traffic	th t	7870	34 %	7870	8,330
Transit traffic	th t	7,960	36 %	7,960	8,750

4.1.2 Evaluation of operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	8	8	14	14	18
Annual average distance run	km	30,668	87,109	217,587	218,835	341,919
Freight trains						
Average speed	km/h	35	35	50	50	50
Average train load	t	3,000	3,000	3,000	3,000	3,000
Average wagon load	t	50	50	50	50	50
Wagon turn around	days	10	10	8	8	6
Annual distance run per wagon	km	24,271	42,484	48,680	49,619	66,159
Passenger trains						
Average speed	km/h	45	45	60	60	90
Average train ridership	pass	960	720	500	400	300
Average coach per train		16	12	10	8	6
Annual distance run per coach	km	77,972	84,522	112,696	112,696	169,043

4.2 Rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	233	90	39	45	34
Freight trains		64	24	26	20
Passenger trains		25	16	19	13
Shunting locomotives	98	60	60	40	40
Passenger coaches	401	370	333	333	222
Wagons - total	12,834	7,332	5,866	6,330	4,747
Open - PV	2,118	1,210	968	1,045	783
Tank - TS	2,753	1,573	1,258	1,358	1,018
Covered - KR	2,856	1,632	1,305	1,409	1,056
Refrigerator - XX	700	400	320	345	259
Platform - PL	3,253	1,858	1,487	1,604	1,203
Hopper - ZR	476	272	218	235	176
Others	678	387	310	334	251

4.3 Maintenance facilities requirements

4.3.1 Locomotive maintenance facilities

Main line locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel main lines locomotives	466	179	78	91	34
Annual run of a locomotive km	30,668	87,109	217,587	218,835	341,919
Running inspection					
Production of TO3 / TR1	9,320	3,580	1,565	1,814	134
Production of TR2	308	118	52	60	22
Production of TR3	154	59	26	30	11
Overhaul					
Production of KR	93	36	16	18	5

Shunting locomotives

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	98	60	60	40	40
Running inspection					
Production of TO3 / TR1	980	600	600	400	80
Production of TR2	39	24	24	16	13
Production of TR3	25	15	15	10	6
Overhaul					
Production of KR	14	8	8	6	6

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	401	370	333	333	222
Annual run of a passenger coach km	77,972	84,522	112,696	112,696	169,043
Running inspection					
Production of TO2	401	370	333	333	222
Production of TO3	401	370	333	333	
Overhaul					
Production of KR	80	74	67	67	44

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	12,834	7,332	5,866	6,330	4,747
Annual run of a wagon km	24,271	42,484	48,680	49,619	66,159
Running inspection					
Production of TR	12,834	7,332	5,866	6,330	4,747
Overhaul					
Production of KR	1,283	733	587	633	475

5. Recommendations

5.1 Management

Taking into account the dimension of the country, it is recommended to set up a central maintenance management department. The line inspection (first level) and drivers have to be managed by the train operation department. This maintenance department will be in charge of running maintenance, overhauls and of the maintenance and replacement of equipment and components. It will also be in charge of the spare parts procurement co-ordination. Special attention has to be paid to maintenance monitoring and failure follow up.

This maintenance department will define the maintenance rules, the equipment upgrading and procurement and will be in charge of co-ordinating resource which could be shared between depots and workshops dealing with the same maintenance level and the same vehicle types.

Each depot and workshop will be organised in business unit.

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level. Special care has to be borne in the implementation of a centralised information system which will collect data in each of the depots and workshops M. I. S.

USD 6 millions have to be allocated for restructuring and M.I.S. implementation.

Moreover, it is recommended that identical technologies are gathered in one back shop (central workshop in the third level organisation) to minimise future investments in new machinery and equipment, and last not least unite the specialist for the various tasks.

5.2 Rolling stock

5.2.1 Locomotives

To deal with the current situation, 180 locomotives are required : 100 main line diesel and 60 shunting.

180 are available : 120 main line diesel and 60 shunting.

Moreover, their average age is less than 15 years old, therefore, the required locomotives can be chosen among the youngest ones. It is recommended to rid of the excess locomotives.

Improvements of train operation performances could allow to reduce even more the fleet to 1200.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 100.

However, the main lines locomotives are rather old and and investment of 20 locomotives is recommended within the 10 next years. To acquire locomotives it is recommended to reach an agreement with neighbour countries where locomotives in good condition are available.

USD 10 millions have to be allocated for second hand locomotives.

60 shunting locomotives among the 98 existing ones, are required for a short term basis. The existing shunting locomotives are reliable and efficient, they could run more than 30 years. Incentives or restructuring of terminal loading stations have to be encouraged in order to reduce as much as possible the number of shunting locomotives and therefore, to reduce the maintenance costs of this rolling stock.

5.2.2 Passenger coaches

For the time being, all the available fleet is required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches will appear is the next years, the existing ones will be needed during at least 10 to 15 years for long distance services. Rehabilitation and modifications have to be carried out in those existing ones.

USD 50,000 have to be allocated to each of the 400 coaches during the 10 next years.

5.2.3 Wagons

The fleet of existing wagons (12,000) can cover the current needs (7,500). Improvements of operation performances could allow to reduce that requirement to 5,000.

Therefore, it is recommeded to refurbished 2,000 of them, to carry out relevant overhaul and to utiise original spare parts.

USD 20,000 have to be allocated for refurbishment of each of 2,000 wagons or procurement of new ones

5.3 Maintenance facilities

5.3.1 Locomotive maintenance facilities

The 5 depots are not necessary to maintain the 150 locomotives required to deal with the current situation. Therefore, it is recommended to improve the conditions of 2 of them and to close down the other ones.

It is proposed to keep working Ashgabad and Chardjev depots

The depots need comprhensive overhaul, clenaing and renewal of some machinery. The best machine tools and workshop equipment of the depots which will be closed have to replace the oldest machine tools and equipment of the depots which will be kept working.

Ashgabad depot could be restructured and split in 2 areas :

- light inspection (TO3, TR1, TR2) fitted with 6 bays (3 double sets) ;

- heavy inspection (TR3) fitted with 1 bay (1 double set)

USD 10 millions have to be allocated for the improvement of those 2 depots.

5.3.2 Coach maintenance facilities

One of the 2 depots should be enough for the running maintenance of the whole fleet of passenger coaches. Moreover, the capacity required for overhaul maintenance is rather low, and could be gathered to wagon overhauls.

The maintenance of electrical equipment should be sent to a specialised workshop.

USD 2 millions have to be allocated for the improvement of this depot.

5.3.3 Wagons maintenance facilities

The 4 running maintenance depots for wagons should be kept working.

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph will include a relevant spare parts management system. However, the railways will not be able to survive more than 3 or 4 years if nothing is done urgently to perform the maintenance as it should be. Original spare parts have to be utilised and worn components have to be replaced.

USD 4 millions have to be allocated to the urgent needs of spare parts.

5.5 Investment plan for the next 10 years

Investment - USD million	Period 1995-2000	Period 2000-2005
Urgent needs of spare parts	4	
Restructuring - M I S system	6	
Locomotives		10
Passenger coaches	10	10
Wagons	20	20
Maintenance facilities	7	5
Total	37	45

UZBEKISTAN Railways

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1. Overall

1.1 Infrastructure

Length of the network is 3655,7 Km whereof 680,6 km are double track. There are 11 workshops for locomotive maintenance. The track gauge is 1520 mm and the average distance between two stations is 10-15 km. There was no information available concerning profile and tunnels (secret)

They have 480 km electrified double track (25 kV AC).

The lines have border as following:

• Chengeldi (excl) - Baineu (excl)	Kazakhstan
• Tahiatash (excl) - Cubadag (excl)	Turkmenistan
• Cross-point 449 (excl) - Gazachak (excl)	Turkmenistan
• Hodjadavlet (incl.) - Talimardjan (excl)	Turkmenistan
• Cross-point 161	Turkmenistan
• Bekabad (incl.) - Kanibadam (excl)	Tadjikistan
• Sari-assia (incl.) - Amuzang (excl)	Tadjikistan
• Uch-Kurgan (incl.) - Kara-su (excl)	Kyrghyzstan
• Hanabad (incl.) - Kisil-kia (excl)	Kyrghyzstan

1.2 Management organisation

Uzbekistan railways is divided into five railway departments:

- Tashkent (Tashkent)
- Fergana (Kokand)
- Bukhara (Bukhara)
- Aral area (Kungrad)
- Karshi (Karshi)

Each of them constitutes a small independent entity except concerning their budget for which they depend on the central management.

A comprehensive railway education system is constituted of :

- Tashkent Railway Engineer Institute
- 3 Technical schools for railway technicians
- the railway medical technical school

1.3 Operation

The general train operation management is performed by the main train operation centre in Tashkent. Each geographical department has its own local train operation centre. Some lines are provided with auto-block signal systems and some stations are fully automatic.

The train performances are characterised by the following speeds:

- passenger : 100 km/h, average 40 km/h, 60 km/h on the Tashkent - Samarkand line
- freight : 80 km/h, average 38 km/h

The average distance between two stations is 10-15 km and the average running time for a train between two basic stations is 4-6 hours.

Daily average passenger trains : 20

Daily average freight trains : 130

Freight loading/unloading is possible on 180 stations in Uzbekistan. Loading of tank wagons with oil and oil products for export is possible on the following stations : Karauid-Bazar, Sulphur factory, Shurtan, Akhunbabava, Altiarik and Pakhta.

Loading of 20-feet containers is possible on 11 container terminals in Shumilava, Djizak, Karir, Margilan, Andijan, Raustan, Ulugbek, Tinchlik, Bukhara, Karshi, Urgench. Loading of 40-feet containers is only possible to do in Shumilava by a private company.

Delays and accidents from 1992 - 1995

Type	1992	1993	1994	1995
Serious accidents (fatal)	0	0	1	0
Materiel damage	1	1	0	1
Train crash	0	0	0	1
Derailments	7	0	21	21
Delays more than 1 hour	229	174	173	121
Minor incidents	654	597	413	252

Operation costs and revenues)

Costs (mil sum):

Purpose	1989	1991	1993	1994	1995	1996	1997	1998
Transport	0.7	1.7	142.0	1,105.8	9,611.6	11,885.0	14,262	15,300
Maintenance	0.1	0.2	16.2	170.4	1,091.5	1,518.0	1,973	2,170
Constructio n	149.0	214.9	38.2	504.0	2,087.5	11,155.3	20,177	20,472
Total	149.9	216.8	196.4	1,780.2	12,790.6	24,558.3	36,412	37,942

Revenues (mil sum)

Type	1992	1993	1994	1995	1996	1997	1998
Freight	17,133	162,982	1974,616	8119,015	7228,204	8508,962	8778,477
Passenger	1,057	12,486	137,199	597,808	607,233	626,629	646,565
Total	18,190	175,468	2111,815	8716,823	7835,437	9135,591	9425,042

1.4 Traffic

The volume of passenger and freight transport for 1989 to 1993 is shown below:

Year	mil passenger-km	mil ton-km
1989	5,548	78,716
1990	5,450	76,783
1991	5,719	72,404
1992	5,653	50,634
1993	5,887	39,254

Quantity of passengers transported in 1989 - 1995 (in thousand)

Type	1989	1993	1994	1995
International	3,902	2,088	2,098	1,390
Domestic	9,069	6,641	7,602	2,281
New local (metro)	19,090	12,727	13,779	19,771
Total	30,549	21,459	23,479	14,442

Quantity of freight transported in 1989 - 1995 (in thous. ton)

Type	1989	1993	1994	1995
Coal	8,847	3,491	2,475	3,614
Oil	16,973	14,150	11,871	16,155
Ore	1,719	2,511	1,948	
Cotton	2,541	1,477	1,307	1,356
Total	123,185	57,232	40,059	46,209

Transportation of freight types in % of total (1995)

Type	100 %
Grain and bread products	3.6 %
Coal	8.8 %
Oil and oil products	11.8 %
Black metal	1.2 %
Wood	0.2 %
Chemicals	4.6 %
Construction materials	36.9 %
Cement	5.6 %
Cotton and other things	27.3 %

2. Rolling Stock

2.1 Locomotives

Existing fleet

Type of locomotive	Quantity of locomotives	Quantity of units
3TE10M	121	363
2TE10P	53.5	107
2TE10V	81	162
2TE10M	176.5	353
2TE116	48	96
2TE2	0.5	1
TOTAL	480.5	1,082

Shunting locomotives

Type of locomotive	Quantity of locomotives	Quantity of units
TEM2	185	185
ChME3	128	128
TOTAL	313	313

Electrical locomotives

Type of locomotives	Quantity of locomotives	Quantity of units
3VL80S	34	102
2VL60K	21	42
VL80S	1	1
VL60K	28	28
Total	84	173

Train sets

Type	Quantity of sets	Quantity of units
ER9E	33	66
ER2	12	24
Total	45	90

Train sets of type ER2 is using DC energy and that is why they do not use them anymore.

Age of the fleet

Diesel locomotive

Type	Quantity	Age (years)						
		30	30-26	25-21	20-16	15-11	10-6	5-0
3TE10M	121					99	22	
2TE10P	53.5			29	24.5			
2TE10V	81				77	4		
2TE10M	176.5					103.5	70	3
2TE116	48				31	17		
2TE2	0.5						0.5	
TEM2	185		17	66	58	38		6
ChME3	128					61	63	4
Total	793.5		17	95	190.5	322.5	155.5	13

Electric locomotives

	Quantity	Year of purchase
3VL80S	34	1987 - 1991
2VL60K	21	1961 - 1967
VL80S	1	1984
VL60	28	1961 - 1967
Total	84	

About 58% have more than 30 years old.

Train sets

	Quantity	30	30-26	25-21	20-16	15-11	10-6	5-0
ER9E	33					12	21	
ER2	12			8		4		
Total	45			8		16	21	

2.2 Passenger coaches

About 200 coaches are out of order due to their age (more than 28 years). The total amount of wagons is 1457.

Breakdown per age and type.

Year	SV	TSMK	TSMO	MObl	P/V	VR	Other	Total	%
1950-59		1			15		7	23	1.6
1960-69		86	23	49	24	23	20	225	15.5
1970-79	16	133	365		20	8	6	548	37.7
1980-89	9	196	310			31	5	551	37.9
1990-95	2	60	40			4	1	107	7.7
Total	**27**	**476**	**738**	**49**	**59**	**66**	**39**	**1,454**	

2.3 Freight wagons

Breakdown per age and type

Type	19??-1969	1970-79	1980-89	1990-95	Total
KR, closed	2,169	3,527	2,856	418	8,970
PL, platform	1,652	1,412	1,344	161	4,569
PV, open	693	2,012	3,679	641	7,025
TsS, tank	1,531	1,310	1,362	281	4,484
XX, refrig.	167	70	1,564	104	1,905
PR, closed	1,287	828	3,012	449	5,576
Total	7,499	9,159	13,817	2,054	32,529

Wagons out of order, breakdown per cause :

Cause of unavailability	Nos.	% of unavailable	% of total fleet
Lack of wood for floor	1250	24.0 %	3.84 %
Lack of doors	235	4.4 %	0.72 %
Lack of platform edges	227	4.3 %	0.69 %
Lack of wheels	337	6.4 %	1.04 %
Coupling devices failures	46	0.9 %	0.14 %
Brakes failures	98	1.8 %	0.31 %
Have reached their lifetime	1154	22.0 %	3.54 %
Wait for overhaul	1918	36.4 %	5.89 %
Total	5265	100 %	16.18 %

3. Maintenance

3.1 Locomotives

3.1.1 Production

Electrical locomotives

The overhaul maintenance (KR-1 and KR-2) are performed abroad, the production was as follow :

Year	1990	1991	1992	1993	1994	1995
Number of units	11	10	12	1	9	9

In 1994 Uzbek railways carried out TR-3 on 26 units, in 1995 they planned to carry out TR-3 on 45 units.

Diesel locomotives

The overhaul maintenance is carried out in Tashkent workshop. The workshop carried out overhaul for some of the neighbour countries.

Maintenance production for the last four years

Country/origin	1992 KR-1,2	1993 KR-1,2	1994 KR-1,2	1995 KR-1,2	1996 KR-1,2
Uzbekistan	98	68	65	83	74
Industry	222	250	3	10	20
Tadjikistan			4	9	14
Kyrghyzstan			5	3	13
Kaz. Almaty			96	23	10
Kaz. west			53	3	
Total	320	318	226	131	131

They planned to carry out 28,8 KR(1,2) inspections in 1995, but they only succeeded in carrying out 9.

3.1.2 Locomotive maintenance facilities

Depots for TO3 / TR1 maintenance	Year of construct or rehab	Capacity TR2 / TR3 year	Capacity TR1 year	Comments
Tashkent - Uzbekistan	1977	44	698	Mainline electric
		40	196	Commuter trains ER9
Tashkent	1903	61	74	Mainline diesel
		36	89	Shunting
Kokand	1898	88	177	Mainline diesel
			51	Shunting
Andijan	1907		48	Mainline diesel
		47	63	Shunting
Samarkand	1897	9	102	Mainline diesel
			36	Shunting
Boukhara	1898		110	Mainline diesel
			36	Shunting
Tinchlik	1968		58	Mainline diesel
			16	Shunting
Karshi	1915		112	Mainline diesel
			24	Shunting
Termes	1917		86	Mainline diesel
			37	Shunting
Urgench	1957		165	Mainline diesel
			18	Shunting
Kungrad	1973		203	Mainline diesel
			22	Shunting
Depots for KR1 maintenance	Year of construct or rehab	Number of bays	Capacity KR1 / 2 year	Comments
Tashkent			320	Diesel locomotives

3.2 Passenger coaches

3.2.1 Production

Type of inspection	period	planned production 1996	estimated costs (sum)
TO-3 (DR)	12 months	1000	200.000.000,-
KR-1	5 years	350	192.500.000,-
KR-2	20 years	120	120.000.000,-

Due to lack of spare parts they cannot fulfil their maintenance program. They have to operate wagons over-ran.

The main suppliers are in Germany (Amendorff), the delivery time is about 12 months and in Russia (Tver) who deliver spare parts after having been paid.

The main needs are : wheels, couplers, bogies, parts to the brake system, air-conditioning system, electrical system (generators, relays etc.) and wood.

3.2.2 Passenger coach maintenance facilities

Depots for DR maintenance	Year of construct or rehab	Number of bays	Capacity DR / year	Comments
Tashkent				TO1 to TO3 (DR)
Andijan				TO 1 to TO3 (DR)
Depots for KR maintenance	Year of construct or rehab	Number of bays	Capacity KR / year	Comments
Tashkent				KR1, KR2

3.3 Freight Wagons

3.3.1 Production

TO-1 and TO-2 inspection are carried out on the 180 loading stations distributed in Uzbekistan.

The main problem is the availability of bogies which cannot be produce locally.

3.3.2 Wagon maintenance facilities

Depots for running maintenance	**Year of construct or rehab**	**Number of bays**	**Capacity TR3 / year**	**Comments**
Tashkent	1903	2+2	2585	Covered wagons Staff : 1 021
Havast	1936	2	2200	Opened wagons

				Staff : 855
Kokand	1935	3	3273	Tank wagons Staff : 765
Karshi	1930	2	3883	Platform and covered wagons Staff : 542
Samarkand	1934	3	3416	Staff : 650
Boukhara	1943	2	3388	Staff : 636
Kungrat	1985	3	1500	Covered, platform, opened wagons Staff : 469
Sirdaria	1979	3	1265	Refrigerator wagons Staff : 3 168
Workshops for KR maintenance	**Year of construct or rehab**	**Number of bays**	**Capacity KR / year**	**Comments**
Tashkent	1903	2	500	
Havast	1936	10	312	Opened wagons
Kokand	1935	3	200	Tank wagons
Karshi	1930	2	290	Platform and covered wagons
Samarkand	1934	3	838	Covered wagons
Boukhara	1943	2	200	

4. Future requirement evaluation

4.1 Assumption

4.1.1 Traffic forecast for the next 10 years

year		1995	%	2000	2005
Passenger turnover	th pass.km	3,610,000		3,610,000	3,610,000
Total ridership	th pass	14,442		14,442	14,442
Freight turnover	th t.km	27,475,000		30,223,000	30,223,000
Total freight	th t	46,200	100 %	46,200	50,800
Transit traffic	th t	6,500	14 %	6,500	7,150
Imported by rail	th t	14,300	31 %	14,300	15,750
Exported by rail	th t	12,500	27 %	12,500	13,700
Domestic traffic	th t	12,900	28 %	12,900	14,200
Breakdown of freight per product domestic traffic transit					
Grain	th t	1,670	3.6 %	1,670	1,830
Coal	th t	4,070	8.8 %	4,070	4,470
Oil and oil products	th t	5,450	11.8 %	5,450	6,000
Black metal	th t	550	1.2 %	550	610
Wood	th t	90	0.2 %	90	100
Chemicals	th t	2,120	4.6 %	2,120	2,340
Construction materials	th t	17,050	36.9 %	17,050	18,760
Cement	th t	2,590	5.6 %	2,590	2,850
Cotton and other things	th t	12,600	27.3 %	12,600	13,880
TOTAL		46,210	100 %	46,210	50,830

4.1.2 Evaluation of operation performances

Operation performances		Existing situation	Short term		Long term	
			Altern 0	Altern 1	Altern 1	Altern 2
Locomotives						
Average daily running time	hr	9	9	14	14	18
Annual average distance run	km	36,857	116,640	185,677	185,367	300,523
Freight trains						
Average speed	km/h	45	45	45	45	50
Average train load	t	3,000	3,000	3,000	3,000	3,000
Average wagon load	t	50	50	50	50	50
Wagon turn around	days	6	6	5	5	5
Annual distance run per wagon	km	33,785	113,218	103,783	96,598	96,598
Passenger trains						
Average speed	km/h	45	45	50	50	90
Average train ridership	pass	1,440	1,440	800	800	480
Average coach per train		18	18	10	10	6
Annual distance run per coach	km	31,039	112,696	125,217	93,913	169,043

4.2 Rolling stock requirements

Summary of rolling stock requirements

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Mainline locomotives total	565	179	107	115	81
Freight trains		157	84	93	65
Passenger trains		21	22	22	16
Diesel locomotives	481	152	91	98	69
Electric locomotives	84	27	16	17	12
Shunting locomotives	313	251	250	250	250
Passenger coaches	1,454	400	360	481	267
Wagons - total	32,530	9,707	8,825	10,429	10,429

Types of vehicles	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Wagons - total	32,530	9,707	8,825	10,429	10,429
Open - PV	7,025	2,096	1,906	2,252	2,252
Tank - TS	4,484	1,338	1,216	1,438	1,438
Covered - KR	8,970	2,677	2,433	2,876	2,876
Refrigerator - XX	1,905	568	517	611	611
Platform - PL	4,570	1,364	1,240	1,465	1,465
Others	5,576	1,664	1,513	1,788	1,788

4.3 Maintenance facilities requirements

4.3.1 Locomotive maintenance facilities

Diesel main line locomotives	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel main lines locomotives	1,082	342	204	220	69
Annual run of a locomotive km	36,857	116,640	185,677	185,367	300,523
Running inspection					
Production of TO3 / TR1	21,640	6,838	4,080	4,402	275
Production of TR2	714	226	135	145	45
Production of TR3	357	113	67	73	23
Overhaul					
Production of KR	216	68	41	44	10

Electric main line locomotives	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of electric main line locomotives	173	55	33	35	12
Annual run of a locomotive km	36,857	116,640	185,677	185,367	300,523
Running inspection					
Production of TO3 / TR1	3,460	1,093	652	704	36
Production of TR2	104	33	20	21	12
Production of TR3	57	18	11	12	
Overhaul					
Production of KR	35	11	7	7	1

Shunting locomotives	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of diesel shunting locomotives to be maintained	794	251	250	250	250
Running inspection					
Production of TO3 / TR1	7,940	2,509	2,500	2,500	500
Production of TR2	318	100	100	100	83
Production of TR3	199	63	63	63	38
Overhaul					
Production of KR	111	35	35	35	38

4.3.2 Coach maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of passenger coaches to be maintained	1,454	400	360	481	267
Annual run of a passenger coach km	31,039	112,696	125,217	93,913	169,043
Running inspection					
Production of TO2	1,454	400	360	481	267
Production of TO3	1,454	400	360	481	
Overhaul					
Production of KR	291	80	72	96	53

4.3.3 Wagon maintenance facilities

	Existing situation	Short term		Long term	
		Altern 0	Altern 1	Altern 1	Altern 2
Number of wagons to be maintained	32,530	9,707	8,825	10,429	10,429
Annual run of a wagon km	33,785	113,218	103,783	96,598	96,598
Running inspection					
Production of TR	32,530	9,707	8,825	10,429	10,429
Overhaul					
Production of KR	3,253	971	882	1,043	1,043

5. Recommendations

5.1 Management

Uzbekistan as the former headquarters of the Central Asian region is well equipped and the railway staff is generally well qualified. The railway education system is very well developed

Taking into account the dimension of the country, it is recommended to set up a central management for each of the maintenance level described in the Part 2 Chapter 3 of this report. The line inspection and drivers (first level) have to be managed by the train operation department. A central department will be in charge of running maintenance, of overhauls and the maintenance of equipment and components. It will also be in charge of the spare parts procurement co-ordination.

This department will define the maintenance rules, the equipment upgrading and procurement and will be in charge of co-ordinating resource sharing between depots and workshops dealing with the same maintenance level and for all vehicle types.

Each depot and workshop will be organised in business unit.

Quality control will not be ensure by the drivers, therefore, special attention has to be paid to maintenance monitoring and failure follow up.

Moreover, the Uzbek railway organisation is rather huge (more than 50,000 employees), and so wide restructuring cannot be implemented everywhere at the same time. Therefore, it is recommended to define the proposed organisation and, then, to test it in a pilot area, So adapted organisation will then be applied all over the country.

It should be pointed out that such restructuring is independent from the train operation restructuring and track infrastructures improvement which will allow to increase the train operation performances

An efficient Management Information System has to be set up in each depot and workshop. It will be adapted to the specific needs of each maintenance level. Due to the numerous depots and workshops distributed all over the country, a special care has to be borne in the implementation of a centralised information system which will collect data in each of the depots and workshops M. I. S.

USD 3 millions have to be allocated to the definition and to the test in a pilot area (first phase of restructuring).

USD 2 millions have to be allocated to the restructuring implementation in the workshops and depots which will be kept working (second phase of restructuring). See below the proposal for maintenance facilities.

Those allocations include consulting services, logistics and computers to be installed in the maintenance facilities.

5.2 Rolling stock

5.2.1 Locomotives

To deal with the current situation, 180 locomotives are required : 153 main line diesel, 27 main line electric and 250 shunting.

All are available for operation : 480 main line diesel, 84 main line electric and 313 shunting.

Moreover, their average age is less than 15 years old, therefore, the required locomotives can be chosen among the youngest ones. It is recommended to rid of the excess locomotives.

Improvements of train operation performances could allow to reduce even more the fleet to 115.

Infrastructure improvements together with train operation and maintenance restructuring are necessary prior to introduce a new locomotive generation. Doing so, the required fleet of locomotives could drop to 90.

However, the capabilities of Uzbek railways allow them to test a new generation of electric locomotives. Train operation performances are already rather high on electrified lines. The railways will not face difficulties to increase even more those performances in order to perform an efficient test.

It is pointed out that the introduction of locomotives from a new generation involves comprehensive training and workshop restructuring.

The pilot management introduced in the preceding paragraph has to be implemented together with the introduction of that new technology. Doing so, a very efficient sub-network will be implemented.

USD 50 millions have to be allocated for procurement of new locomotives (test of a new generation)

5.2.2 Passenger coaches

For the time being, only 30 % of the available fleet is required for operation. Due to their technology and the lack of proper maintenance of those last years, the conditions of the passenger coaches are deteriorating rapidly. Even though new types of passenger coaches will appear is the next years, the most of the existing ones will be needed during at least 10 to 15 years for long distance services. Rehabilitation and modifications have to be carried out in 400 of the existing ones.

USD 50,000 have to be allocated to each of the 400 coaches during the 10 next years.

5.2.3 Wagons

The fleet of existing wagons (32,500) is large enough to cover the current needs (9,700). Improvements of operation performances and increase of traffic will require to maintain available such a fleet.

No investments for wagon procurement or rehabilitation are required for the next 15 years. However, good quality spare parts have to be purchased in order to maintain the wagons in good conditions. Allocation of funds for spare parts procurement are proposed in the following paragraph.

5.3 Maintenance facilities

5.3.1 Locomotive maintenance facilities

The 11 depots are not necessary to maintain the 180 locomotives required to deal with the current situation. Therefore, it is recommended to improve the conditions of some of them and to close down the other ones in order to increase efficiency of the remaining ones.

The proposed workshops to be kept opened are:

- Uzbekistan depot for electric locomotive
- Tashkent plant for overhaul of diesel locomotive
- Tashkent depot for diesel locomotives
- Kokand depot for diesel locomotive
- Urgench depot for diesel locomotive
- Kungrad depot for diesel locomotive

Uzbekistan, Urgench, Kokand depots have to be improved, no rehabilitation are required in Kungrad and Tashkent depots, which could be closed at a long term basis.

Uzbekistan depot has to be adapted to a new locomotive generation.

Generally speaking, it is recommended to set up a stronger policy concerning staff security in job site, and to improve general working conditions : acquire handling tools, improve cleanliness and walkway conditions

USD 1 million have to be allocated to the improvement of Urgench and Kokand depots.

USD 5 million have to be allocated for Uzbekistan depot adaptation to a new technology.

5.3.2 Passenger coaches workshop

Taking into consideration the small amount of passenger coaches to be maintained, it is recommended to centralise all maintenance in Tashkent depot.

Improvements are required in that depot in order to increase efficiency and personnel security. Management restructuring will allow to increase the efficiency of the production.

USD 1 million have to be allocated for improvement of Tashkent depot.

5.3.3 Wagon workshops

In order to carry out the running maintenance of the 9,700 wagons required to deal with the current situation, 5 of the 8 depots are necessary. Therefore, it is recommended to keep working the following running maintenance depots : Kokand, Karshi, Samarkand, Kungrad, Sirdaria.

Kokand, Karshi, Samarkand will deal with the overhaul maintenance of the whole wagon fleet.

USD 1 million have to be allocated to each of those 5 depots in order to improve their conditions and to adapt them to the requirements of the restructuring.

5.4 Spare parts procurement

The management restructuring described in the preceding paragraph includes an efficient spare parts management system. Original spare parts have to be utilised and worn components have to be replaced. Urgent needs of spare parts are required to fulfil the maintenance rules. The needs of spare parts mainly concern :

- wood
- bogie components , and
- electric motor components.

USD 15.5 millions are to be allocated for procurement of spare parts.

5.5 Local spare parts manufacturing

An agreement was signed in May 1996 between Uzbekistan, Kyrghyzstan and Kazakhstan to establish co-operation for local manufacturing of spare parts. It is recommended to enlarge such an agreement to other countries and to implement the agreement.

The Part 2 Chapter 3 of this report proposes a working plan for such implementation. The components and the quantity to be produced have to be thoroughly analysed. The distribution of the plants has to be negotiate between those countries.

USD 1 million have to be allocated to assist such initiative.

5.6 Investment plan for the next 10 years

Investment : USD million	Period 1995-2000	Period 2000-2005
Urgent need of spare parts	15.5	-
Management - M I S system	3	2
Test of new generation of locomotives	-	50
Passenger coaches	10	10
Maintenance facilities	13	
Total	41.5	62