JAPAN INTERNATIONAL
COOPERATION AGENCY(JICA)

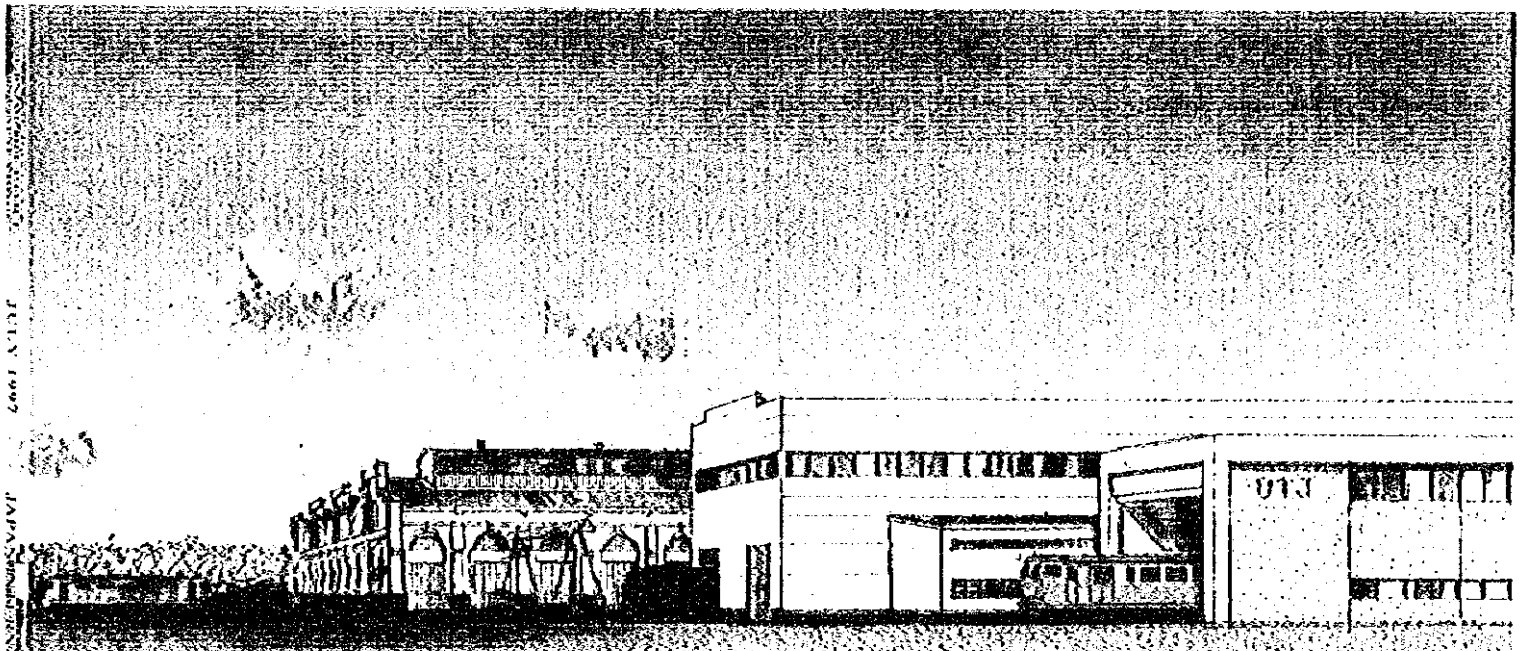
NO. 7

REPUBLC OF UZBEKISTAN

社会開発調査部報告書

THE FEASIBILITY STUDY
ON
THE CONSTRUCTION OF ELECTRIC LOCOMOTIVE REPAIR WORKSHOP
IN
UZBEKISTAN

FINAL REPORT
(SUMMARY)



JULY 1997

JAPAN RAILWAY TECHINICAL SERVISE
JAPAN TRANSPORTATION CONSULTANS,INC.
PACIFIC CONSULTANTS INTERNATIONAL

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Exchange rate of currency

1 US$ = 120¥

1 US$ = 100Sum (Market rate)

Application date January, 1997

PREFACE

In response to a request from the Government of Republic of Uzbekistan, the Government of Japan decided to conduct a feasibility study on the construction of electric locomotive repair workshop in Uzbekistan and entrusted the study to the Japan International Coopration Agency (JICA).

JICA sent to Uzbekistan a study team headed by Mr. Terado, Senior Technical Advisor,Japan Railway Technical Service,and Composed of menber from Japan Railway Techical Service ,Japan Transportation Consultants,Inc. and Pacific Consultants International, two times between December 1996 and May 1997.

The team held discussions with the officals concerned of the Government of Uzbekistan, and conducted a field survey at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officails concerned of the Government of Republic of Uznekistan for their close cooperation extended to the team.

July 1997

Kimio Fujita

President
Japan International Cooperation Agency

Letter of Transmittal

July 1997

Mr. Kimio FUJITA
President
Japan International Cooperation Agency

It is my great pleasure to submit herewith the Final Report for the Feasibility Study on the Construction of Electric Locomotive Repair Workshop in Uzbekistan.

The report is the result of the Study carried out by Japan Railway Technical Service, Japan Transportation Consultants Inc. and Pacific Consultants International as per the contract with Japan International Cooperation Agency (JICA) from November 1996 to August 1997.

Four alternatives were settled and our proposal, which is suggested as the best alternative for construction of electric locomotives and railcars repair workshop on the site of Tashkent Diesel Locomotive Repair Workshop and is feasible, was accepted.

On behalf of the study team, let me express my heartfelt thanks to the Government of Uzbekistan, especially Uzbekistan Railways, for the generous cooperation, assistance and warm hospitality they extended to them throughout entire period of the Study.

Our thanks are also due to Japan International Cooperation Agency, the Ministry of Foreign Affairs and the Japanese Embassy in Uzbekistan for their valuable advice and support during the Study and preparation of this report.

I sincerely hope this report will be found helpful to UTJ in constructing electric locomotives and railcars repair workshop in Uzbekistan.

Yours faithfully,

Kouji TERADO
Senior Technical Adviser
Japan Railway Technical Service

The Feasibility Study on the Construction of Electric Locomotive Repair Workshop in Uzbekistan

Objective Of Project

In response to the request of the Uzbekistan Government, conducted the feasibility study on the construction of electric locomotive(EL) repair workshop ,based on the repair program to cope with the future extension of electrified lines and expected increase of EL repair.
Study areas are Uzbekistan Depot, Tashkent Diesel Locomotive Repair Workshop(Tashkent Workshop) and their neighboring areas.

Basic Approach and Methodology for Study

(Basic approach)

1. As for the construction, on the site of Uzbekistan Depot or of Tashkent Workshop of electric locomotive and railcar workshop for their fleet in 2010, the alternatives are settled and compared, and for the best case, after confirmation on technical and economical feasibility of the project, the most suitable construction plan of the repair workshop is established.
2. Coordination with the projects of UTJ such as electrification, new line construction and others, which are proceeding or planned, is considered.
3. Workshop construction plan is made in consideration of high technical level of UTJ and related enterprises.

(Methodology)

1. Estimate necessary number of rolling stock in 2010, based on demand forecast, new line construction plan, electrification plan and train operation plan, and settle rolling stock maintenance plan.
2. Assuming that proposed sites of workshop construction are Uzbekistan Depot and Tashkent Workshop, and kinds of repaired rolling stock are EL and EC, settle four alternatives.
   Compare and examine land restriction, environmental problem and construction cost etc. for four alternatives, to choose the most suitable one.
3. As for the most suitable alternative, conduct rough design of workshop, economic and financial analysis, and environmental impact analysis, examine execution and funding plan for the project and make overall evaluation with recommendations.

Content of Project

1. Estimated yearly number of overhauled rolling stock, as 55 ELs, 128DLs and 40ECs, in case that electification scale in 2010 is the same as in 2005.
2. As the most suitable alternative, chose the one in which ovehaul of EL and EC is consucted in Tashkent Workshop.
   Roughly designed the workshop capable of KP-1 and KP-2 for ELs and ECs, and settled workshop construction plan aiming at start of construction work in 2000 and its completion in 2001.
3. Out line of design

Building (m²)		Equipment and Machinery (Set)		Catenary (m)
Construction	Reconstruction	Instllation	Existing	Installation
2160	7812	232	162	1790
Total 9972		Total 394		Total 1790

4. Estimated rough construction cost amounts to 3940 million yen.

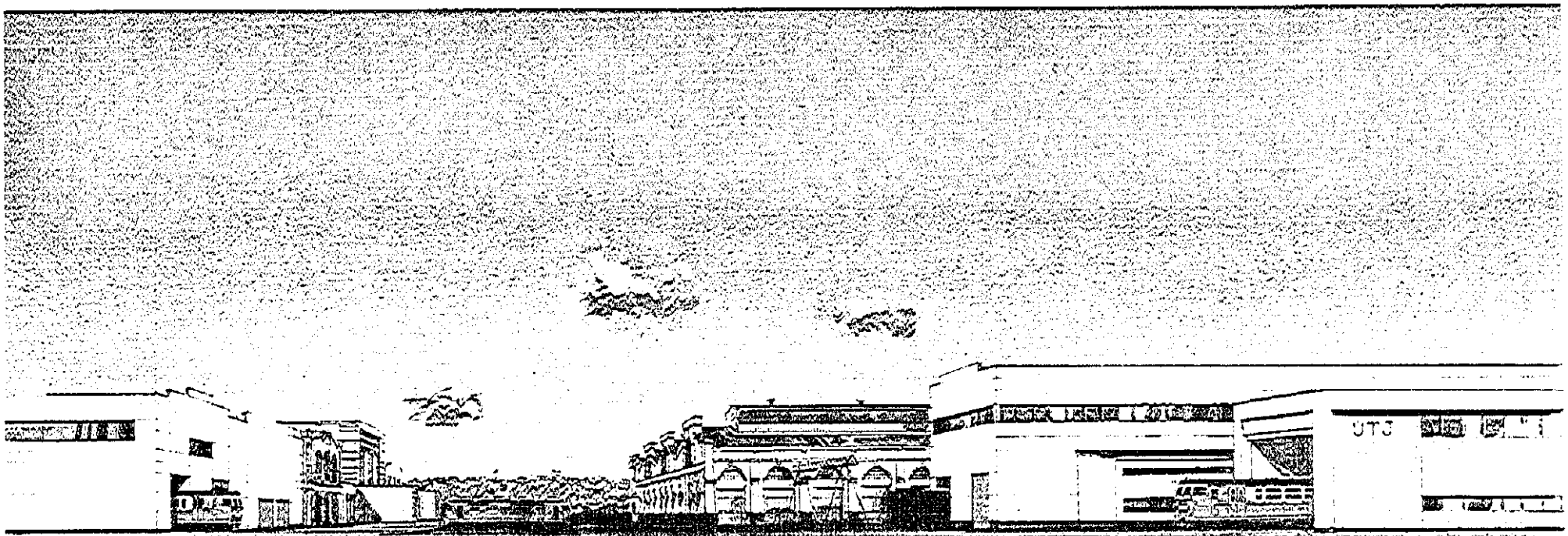
Evaluation Of Project

1. Economic evaluation shows that Case 2 of this project (partial replacement of equipment) has an EIRR of 17.1% and is feasible. And an execution of Case 2 is recommended. However, sensitivity analysis with cost increase by 10% and benefit decrease by 10% indicates 7.1% of EIRR, lower figure than the opportunity cost of capital (=12%), and suggests that Sufficient attentions should be paid to economic and price conditions when the project is implemented. It is judged that Case 1 (total replacement of the equipment) can not be feasible since EIRR is at the level of 10.3%, lower than the opportunity cost of capital.
   Financial analysis shows the same results as the economic analysis. Case 2 has a sufficiently high figure of FLRR of 15.0% to guarantee the profitability of the project, and the implementation of the project (Case 2) is suggested. Sensitivity analysis (cost increase by 10% and benefit decrease by 10%) also indicates that FIRR is lowered to 5.5%, and is significantly affected by changes in cost and benefits. It is suggested that attentions should be paid when the project is implemented.

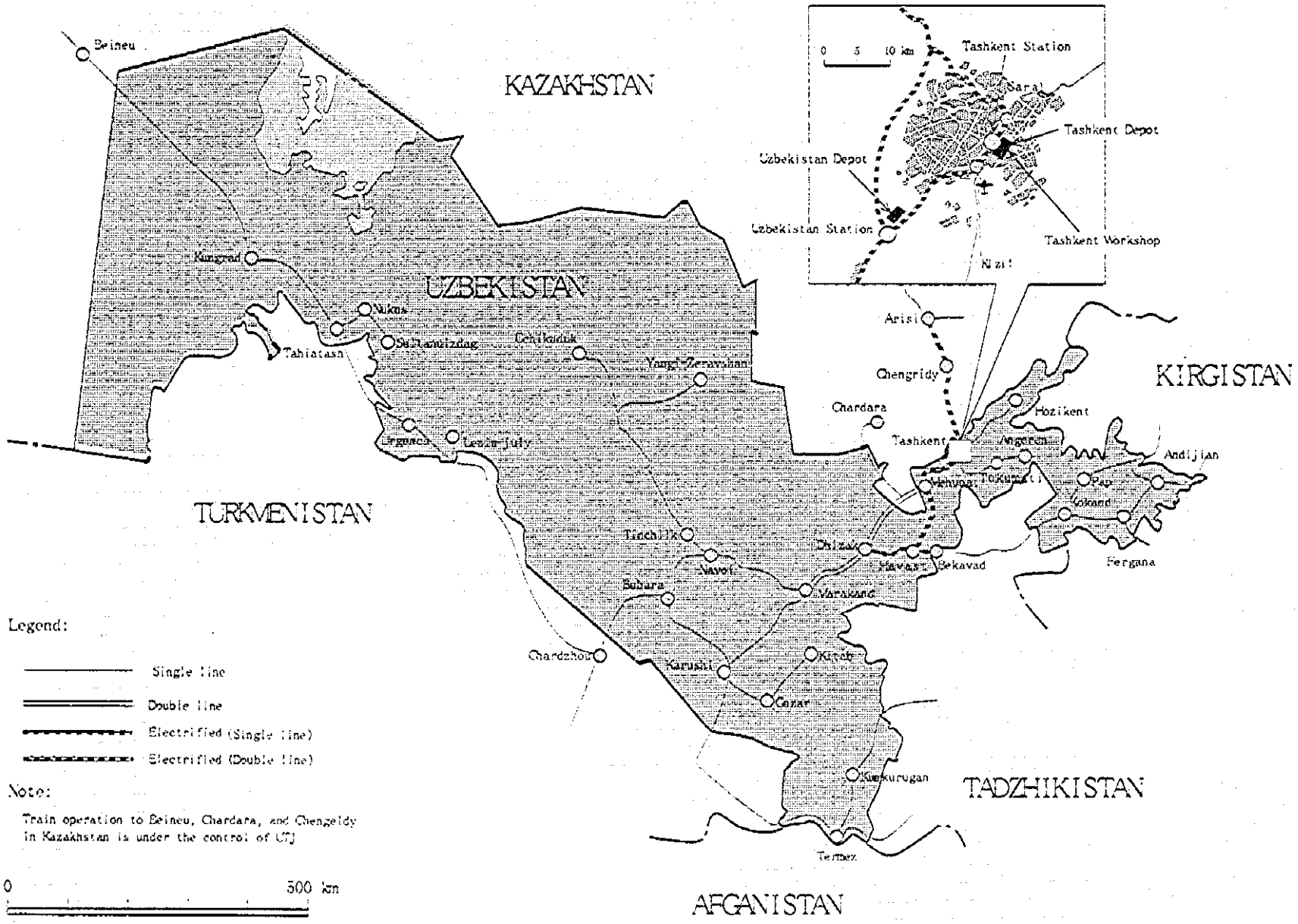
2. No problem relating to initial environmental impact assessment.

Conclusion and Recommendations

It is desirable that construction of electric locomotive repair workshop is preceeded in accordance with the contents of the Final Report.
The project is feasible. There is no problem for construction of EL repair workshop in environmental condition and funding plan.
For the improvement of UTJ and Tashkent Workshop, concerning to demand forecast, transport, rolling stock maintenance, working environment, workshop management and its operation, concretely recommended establishment of comprehensive data-bank of origin and destination information necessary for demand forecast, public announcement or advertising of train operation time table, improvement of cleaning of rolling stock and parts, measures for wastewater treatment facilities and others, early completion of wastewater treatment facilities in Tashkent Workshop and improvement of organization of Tashkent Workshop, etc.



ELECTRIC LOCOMOTIVE REPAIR WORKSHOP



Uzbekistan Railway Network

CONTENTS

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND AND OBJECTIVE OF THE STUDY

Uzbekistan Railways (hereinafter referred to as " UTJ ") have around 3,660 km of service line and have the role of main transport means in the coutry, because the country is the same inland one as the other Central Asian Countries.

After the extinction of Soviet Union and the independence of Uzbekistan in 1991, Uzbekistan has directed the new market economy and been slowly getting rid of economical difficulty directly after the independence, keeping aspect of economical stability.

At present, UTJ have no electric locomotive and railcar repair workshop and so have been obliged to entrust their overhaul to Ukraine and others. Uzbekistan Government has decided to construct electric locomotive and railcar repair workshop in Uzbekistan to save valuable foreign currency and wasteful transport days to foreign country, and to cope with the repair work for electric locomotive and railcar which will increase in number due to the extension of electrified lines along with presumed increase of the transport volume.

Based on the above mentioned background and in response to the Uzbekistan Government, the Government of Japan has decided to conduct the Feasibility Study on the Construction of Electric Locomotive Repair Workshop in Uzbekistan.

1.2 TARGET YEAR OF THE STUDY

The construction of the electric locomotive repair workshop will be completed in 2001.

1.3 BASIC APPROACH OF THE STUDY

The study team shall work in close cooperation with the Uzbekistan counterpart team based on the following basic policy

(1) As for the construction, on the site of Uzbekistan Depot(hereinafter referred to as " Dept or Uzbekistan Depot") or of Tashkent Diesel Locomotive Repair Workshop(hereinafter referrened to as "Workshop or Tashkent Workshop") of electric locomotive and railcar workshop for their fleet in 2010, the alternatives are settled and compared, and for the best case, after confirmation on technical and economical feasibility of the project, the most suitable construction plan of the repair workshop is established..

(2) Coordination with the projects of UTJ such as electrification, new line construction and others, which are proceeding or planned, is considered.

(3) Workshop construction plan is made in consideration of high technical level of UTJ and related enterprises.

(4) Prevention of environmental pollution
New repair facilities shall be installed in consideration of dust and smoke caused by

repair work of electric locomotive and railcar. As for treatment facility of wast water such as surface treating and cleaning water for rolling stock and parts, the recommendation satisfying water quality standard of sewage in Uzbekistan is described.

CHAPTER 2 MACRO-ECONOMY AND SOCIAL ASPECTS

2.1 MACRO-ECONOMY

2.1.1 Economic strategy

(1) Since Independence, the Government has strongly resisted the temptation to adopt 'shock-therapy' tactics in moving to market reforms, preferring instead to take a measured, step-by-step approach and to maintain full control over the process. This policy has not been driven only by economic concerns, but also by a desire for national and social cohesion.

(2) Whether a consequence of this strategy or not, it remains the case that Uzbekistan's real Gross Domestic Product (GDP) has not suffered the same sharp declines since 1991 which most of the other fourteen former Soviet republics have endured.

2.1.2 Economic performance

(1) In 1995,G.D.P. was of the order of 10 billion. Although slight growth had originally been hoped for in 1996, the Government was suggesting mid-year that there would be limit contraction to 1%.

(2) Inflation is gradually being brought back under control from its peaks in 1992 and 1993. The target, set by the IMF, of an annual rate of 21-25% by the end of 1996 was not achieved. Estimates suggest that the final outturn figure will be between 55% and 65%. Official exchange rates continue to over-value the Sum, as evidenced by a thriving black cambio.

(3) The Uzbekistan economy as measured against Government policy objectives is a curate's egg-good in parts. There are many and difficult challenges ahead which will require skill, courage and determination to overcome.

2.2 SOCIAL ASPECTS

2.2.1 Demography

(1) Uzbekistan's population has been increasing for at least the last 57 years. Currently standing at 23.007 million people, it was growing at the beginning of 1996 at a natural rate of 2.34 %.

(2) Most of the population (61.8%) lives in rural areas. The split between genders is 50.4% female, 49.6% male. The ethnic split shows 76% of the population to be Uzbek, 6% Russian, 5% Tadjik, and 4% Kazakh.

(3) A particularly significant feature of Uzbekistan's population is that, in 1994, 41% were under the age of 15, and 68% were under the age of 30. This has important implications not only for the need for future employment, but also in socio-political terms: a young, largely well-educated populace will have both economic and social aspirations which they will be looking to the Government to deliver.

2.2.2 Employment and wages

(1) Under the former Soviet system, everyone of working age was guaranteed a job. As a result, unemployment did not officially exist in the Soviet Union, except in as much as there existed people who simply did not want to work for whatever reason. In practice, though, there were large numbers of 'employed' people for whom there was little or no work to do.

(2) This situation remains true in Uzbekistan today. Official unemployment has been rising steadily since 1992, but it is almost impossible to assess what the true rate is.

(3) Average monthly wages in the industrial sector were 2244 Sum in the first quarter of 1996. By comparison, typical wage-rates of staff working in the Electrical Apparatus shop of the Workshop in December 1996 ranged from 3009 Sum per month for support workers to 7808 Sum per month for skilled technicians.

CHAPTER 3 TRANSPORTATION CONDITION IN UZBEKISTAN

3.1 THE DEVELOPMENT OF TRANSPORT AFTER DEMISE OF THE SOVIET UNION

(1) With the demise of the Soviet Union, all forms of transport have undergone, and continue to undergo, significant change in all of the former republics. To varying degrees, the centrally planned command economy has given way to new systems characterized by four distinct features. First, economic activity has become decentralized both structurally as well as in terms of its geographical spread. Secondly, government has tended to withdraw from direct operational involvement in transport whilst retaining a regulatory role. Thirdly, there has emerged, to a greater or lesser extent, an element of competition between and within modes of transport. And fourthly, new ways of financing transport are having to be sought.

3.2 AIR TRANSPORT

(1) In Uzbekistan today, air transport is run by Uzbekistan Airway, a state-joint-stock company which currently retains vertically integrated structure of its former, Aeroflot. It is responsible for around 20 airports in the republic, and has a fleet of approximately 120 aircraft. The routes served by Uzbekistan Airway and other airlines operating to and from Tashkent include all the major domestic cities, most of the lager cities in the FSU, together with other international destinations. In CIS, 52 inter-city flights on 22 routes between principal cities, and 32 flights on 16 routes between another cities are weekly operated.

(2) In common with all the other Republics, Uzbekistan Airways has witnessed a decline in both passenger and freight carryings since 1991, only partially offset by growth in the international passenger segment.

3.3 ROAD TRANSPORT

3.3.1 The road infrastructure

The emphasis on rail transport in the former Soviet Union entailed a reduced role for road transport. Nevertheless, the road system in Uzbekistan is relatively well-developed. There are about 43,000 km of public roads, which are the main roads outside urban areas and are administrated by public road administration. In addition, there are believed to be a further 28,000 km of non-public roads, which are enterprise and private roads.

3.3.2 Road freight traffic

Although data on Uzbekistan's present lorry fleet is scarce, it is estimated to have conveyed over two billion tonne-kilometres in 1996, representing a decline in activity in keeping with general economic activity. For the future, as the economy recovers, it seems almost inevitable that road freight will begin to grow significantly again as

patterns of distribution emerge that the railways are not well placed, either geographically or economically, to exploit.

3.3.3 Road passenger traffic

(1) In Uzbekistan after Independence, public road transport was between two authorities; Uzavtotrans, and Tashgorpasstrans. The latter has responsibility for all public transport within Tashkent (except for UTJ's operations), whilst the former controls provision in the rest of the republic; this includes urban, intra-urban, as well as some international routes which together generate some 12.5 billion passenger-kilometers.

(2) Empirical evidence suggests that there is a large proportion of Ladas and Moskvitch's, gradually being supplemented by Daewoo's Nexia and Tico models.

3.4 RAIL TRANSPORT

3.4.1 General

(1) With the break-up of the Soviet Union in 1991, strenuous efforts were made to manage the transfer of asset ownership in an orderly manner, with the aim of preserving an integrated network. All the 15 republics have established their own national railway administrations.

(2) UTJ formally came into being in November 1994 by means of Presidential Decree No. 982 dated 7 November 1994. It is a State Joint Stock Company in which the Government holds a nominal 51% of the equity. As with all large enterprises, UTJ also provides a range of social and welfare activities for its 83 thousand staff; in 1996 there were no fewer than 165 medical and educational institutions on UTJ's books.

. Freight transport

UTJ's network covers around 3,660 route kilometres, and is predominantly a freight railway. In common with the rest of the former Soviet Union, freight traffic has declined markedly since 1991.

. Passenger transport

UTJ's passenger business has also suffered decline in total. The total picture does, however, disguise some marked differences between the passenger markets.

CHAPTER 4 DEVELOPMENT PLAN

4.1 DEVELOPMENT PLAN OF UTJ

4.1.1 New line construction

UTJ has three lines which penetrate foreign countries, the first one runs to Aral region via Turkmenistan, the second to Termez・Kunkurgan region via Turkmenistan also, and the third one to Fergana region via Tadjikistan. Payment of foreign currency is necessary by UTJ, because these three lines run in foreign countries. Construction of three lines which run only in respective domestic region without any running in foreign territories were planned in three regions. For the two lines other than that in Fergana region, budgetary measures were taken aiming at their completion in 2000.

As for the line in Fergana region, because of construction difficulties caused by mountainous district, route selection, construction method, fund plan and etc. are now under consideration. Also its completion time is not decided yet. Outline of the new line construction plans is shown in Table 4.1.1 and Fig 4.1.1

Table 4.1.1. Outline of New Line

	1	2	3
The Section	Guzar～Boisun～Kunkragan	Navoi～Uchikuduk～Sultanuizdag～Nukus	Angeren～ Pap
Resolution	New line construction 323(1995-8-17)	Improvement & new line construction 391(1993-8-6)	New line construction The project ,including the selection of the route, construction methods, Possibility, funds, etc., were examined in 1991
General planner	UTJ	Traffic Research Institute UTJ	
Sub-planner	Kazak State railway Research Institute Traffic Research Institute		
Construction company	State Uzbeki Transstroy Ministry of Energy Ministry of Communication	State Uzeki Transstroy Road Construction Bureau Ministry of Energy Ministry of Communication	
Construction period	1995～2000year	1995～2000year	
Founds source	State Budget 500 mil. Sum N123-1996,3,27	State Budget 650 mil. Sum N123-1996,3,27N3981996,11,13	
Route length	223.1Km	796.2Km	165.5Km
Number of station	15	33	11
Max. Gradient	9‰	9‰	12‰
Station yard Effective Length	300 m	400 m	300 m
Max. Speed	110Km/h	110Km/h	110Km/h
Gradient at station	2.5 ‰	0 ‰	2.5 ‰
Kind of track	Single	Single	Single
Train operation (Turnaround)	Freight Train 7 Passenger Train 5	Freight Train 20 Passenger Train 7	Freight Train 15 Passenger Train 5

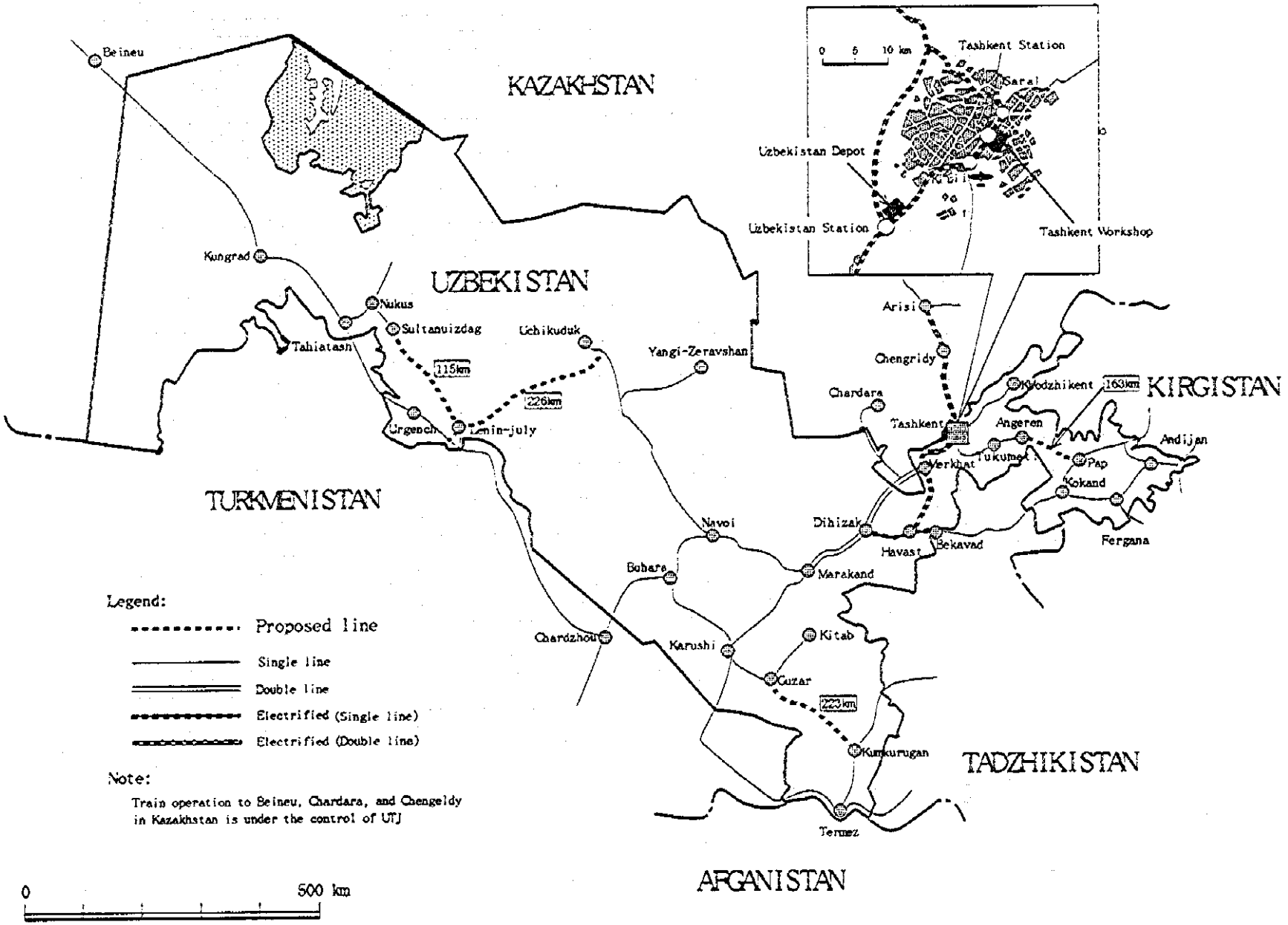


Fig.4.1.1 Outline of New Line

4.1.2 Electrification plan

A part of UTJ main lines are partially electrified (9.8 % of total route length), and electric railcar trains are operated in the suburbs, also freight trains and a part of long distance passenger trains are electric locomotive hauled.

All main lines of UTJ have been decided to be electrified, for saving fuel expenditure of diesel locomotive traction. Aiming at the completion in 1997, electrification of lines between Dihizak and Marakand, Dihizak and Mchunat, Salar and Hozikent (D.C.→ A.C.) are now under construction.

Construction company are Uzbekistan National Transport Construction Association and Ministry of Energy in Uzbekistan
For the electrification, so far UTJ has expended 194 mil. Sm. for 6 years since 1991.

Moreover, lines between Marakand and Buhara, Buhara and Karushi, Karushi and Marakand are now under electrification plan.
Hereafter, for the electrification, 370 mil. US$ will be necessary for 6 years from 1997.

After the completion of electrification, all trains on electrified lines will be electric locomotive hauled (a part of suburban trains will be changed to electric railcar train)in place of diesel locomotive, without speed up and additional train operation.

The line route between Bekabvad and Kokand is in Tadjikistan territory, and will be electrified by Tadjikstan authority and not by Uzbekistan.
Outline of electrification plans is shown in Table 4.1.2 and Fig.4.1.2

Table 4.1.2 Outline of Electrification

a) Present Operation

Section	Distance
Chengridy ~Tashkent	78.0 km
Tashkent ~ Havast	151.7 km
Havast ~Dhizak	89.5 km
Havast ~Bekavad	39.7 km
Total	358.9 km

Note; Saral~Hozikent line is under construction for alteration from D.C. to A.C., so it is not included in present operation.

b) Under Construction

Section	Distance	Period	Train Operation	Rolling Stock
Dhizak～ Marakand	130km	1997	All trains will be hauled by electric locomotives.	EL 20 locomotives: 34sections
Dhizak ～ Mehunat	131km	1997	All freight trains & long distance passenger trains will be hauled by electric locomotives. Short distance trains will be electric railcar trains	
Saral ～ Hozikent (DC→AC)	65km	1997	All freight trains will be hauled by electric locomotives. All passenger trains will be electric railcar trains.	EL 6 locomotives: 12sections EC 50sections

c) Electrification Plan

Section	Distance	Period	Train Operation	Rolling Stock
Kizil ～ Tukumati ～ Angeren	114km	2005	All freight trains & long distance passenger trains will be hauled by electric locomotives	
Marakand ～Buhara	231km	2005	All freight trains & long distance passenger trains will be hauled by electric locomotives. Short distance trains will be electric railcar trains.	
Marakand ～ Karushi	139km	2005	//	
Karushi ～ Buhara	157km	2005	//	

Although the second stage of electrification plan is not decided yet, sections of Urgench ～Kungrad ～ Beineu, Kokand～Anjijyan, and Navoi～Uchikudak～Nukus ～Beineu partially containing the new line now being constructed, are in consideration as the second stage. They would be about 2800km and 80% of the whole line in total.

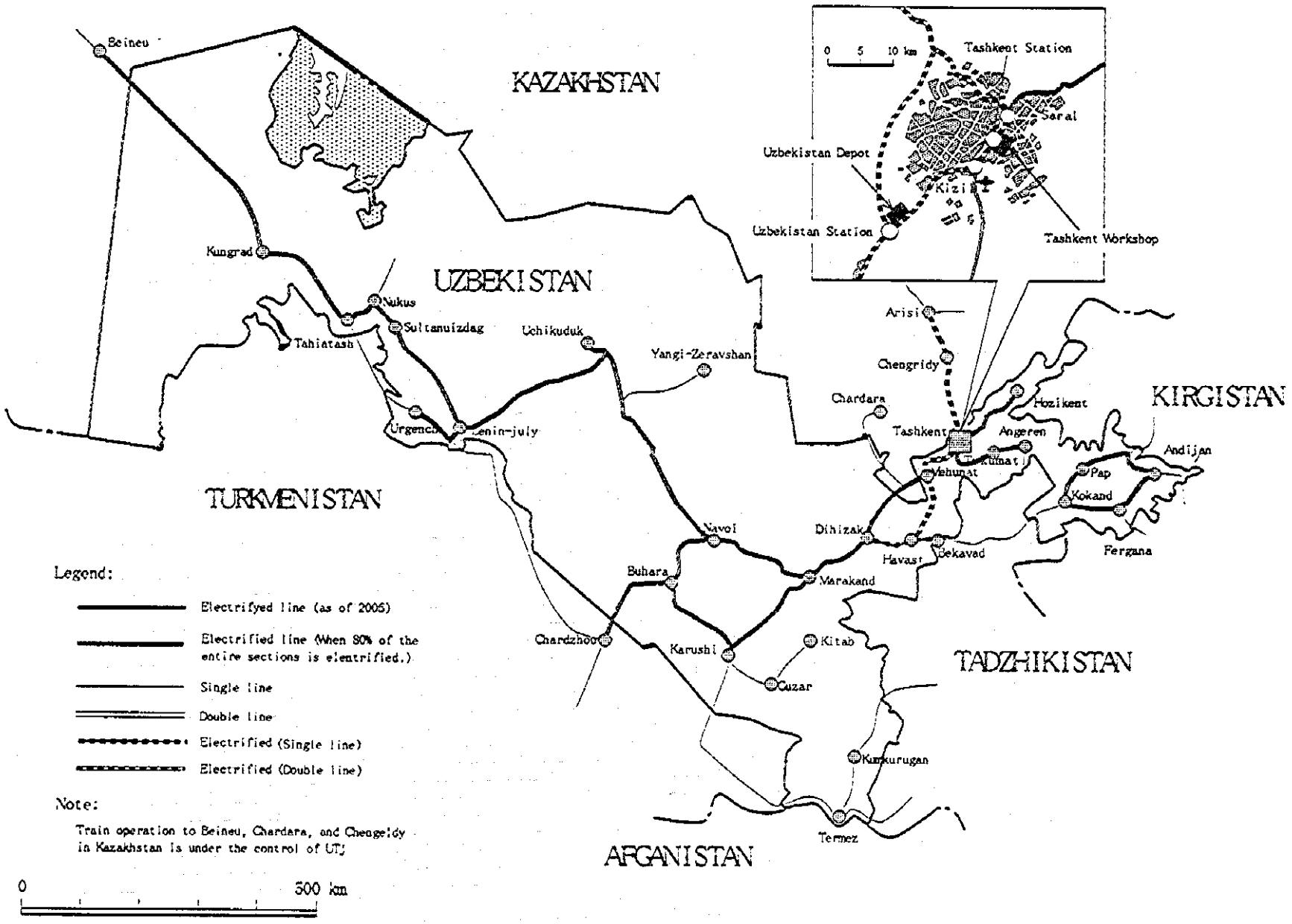


Fig.4.1.2 Outline of Electrification

4.1.3 Rolling stock procurement plan

The realization of the following rolling stock procurement plan by foreign loan is being desired.

	Number	mil .US$
Electric railcar	M(12),T(6)	9～10
Electric locomotive VL65(1 section)	10 sections	20
Electric locomotive (GEC Alsthom)(2 sections)	20～24 sections	25
Spare parts		10～15

4.1.4 Foundry shop and related shops reconstruction plan of Tashkent Workshop

In order to cope with the environmental problem possibly caused by foundry shop and related shops of Tashkent Workshop located in city center, the shop reconstruction is planned as follows.

The early realization of this reconstruction by foreign loan is being desired.

(1) Translocation of Foundry shop including non-ferreous work : 32.4milUS$

(2) Translocation of Steel casting shop and close down of its stock yard for mixed material of ore and solvent : 46.5milUS$

(3) Translocation of Foundry shop and Steel casting shop : 60milUS$

4.1.5 Rolling stork repair workshop construction plan

(1) Passenger coach repair workshop. (68 mil. US$)

Thanks to the OECF loan, the construction work is going to start.

(2) Electric locomotive and railcar repair workshop (Foreign currency 25～30 mil.US$)

It is now under feasibility study by the JICA. Foreign loan for the construction is being desired.

(3) Other than the above, the construction of the following three workshops to repair freight wagons by foreign loan is being desired.

1) Tank wagon repair workshop near Buhara, along with procurement of 500 tank wagons (80 mil. US$)

2) Repair workshop for covered, open and flat wagons at Andijan, along with procurement of 500 wagons. (80 mil. US$)

3) Repair workshop for hopper wagon at Havast, along with procurement of 500 hopper wagons (80 mil. US$)

4.1.6 Other important plan

Track rehabilitation project by foreign loan of 60 mil. US dollars is planned in 1998.

4.1.7 Attitude of Tashkent city toward The Project

Tashkent city supports the construction project for electric locomotive repair workshop. The area of 189,000 m^2 adjacent to Tashkent Workshop could be given even tomorrow. And, the workshop could continue to use this area for 100 years or more.

4.2 TASHKENT CITY DEVLOPMENT PLAN

Tashkent city has the General Development Plan 2010 which includes the following transportation fields.

(1) Establishment of joint enterprise with foreign company which manufactures and repairs street car and trolley bus.

(2) Construction of manufacturing factory of engine for automobile.

(3) Construction of manufacturing factory of modern tractor the license of American company.

(4) Manufacturing of new type airplanes, Iljushin 76MTF and Iljushin 114, designed by Russia.

CHAPTER 5 ENVIRONMENTAL ASPECTS

5.1 NATURAL AND ENVIRONMENTAL CONDITION OF UZBEKISTAN

(1) Uzbekistan is located in the heart of the Eurasian Continent and has no any port. The neighbor countries, Kazakhustan, Kirgistan, Tadzikistan, Turkmenistan and Afganistan, have no any port and Uzbekisatn is only one double land-locked country in the world.

Desert and steppes occupy three fourth of the land and it is semi-dry continental climate. The difference between heat and cold temperature is large and it is 40°C or more in summer and rarely minus 20°C or less in winter. The two big rivers of Central Asia, Amu-Dar'ya and Syr-Dar'ya, rise from the Pamirs and the Tien Shan and flow into the Aral'shoye More running both side of the Paski Kygylkum..

(2) Uzbekistan has enacted several laws to address environmental problems such as State and Sanitary Control, Environmental Protection, Water and Water Use, Land, Specially Protected Natural Area, Air Protection, Protection and Use of Wild Life, etc..

(3) As for environmental standard, there are water quality standard which specifies in terms of the maximum permissible concentration, water quality standard for discharge to municipal sewage systems and air quality standard which limits permissible concentration on the atmospheric air protection.

5.2 TASHKENT WORKSHOP

5.2.1 Water supply

At present, the Tashkent Workshop is supplied with water from two artesian well #1 and #2 which are located in the territory of the Tashkent Workshop and from the municipal water supply system. The actual water consumption of Tashkent Workshop is 80 % of the allowed level.

5.2.2 Wastewater

Industrial wastewater (579 m^3/day) with oil products goes to the treatment facility to reduce the oil content from wastewater. The quality of treated water is not sufficient for discharging into the municipal sewage system. Therefore, proposed waste-water treatment facilities are under way.

Comparatively clean industrial wastewater after cooling of equipment (2590 m^3/day) and domestic wastewater (567 m^3/day) directly goes to the municipal sewage system.

5.2.3 Air pollution

Tashkent Workshop has 372 sources of pollutants. The maximum allowable rates for the Tashkent Workshop are approved by the State Committee on Nature Protection in 1992. The allowed annual emission of pollutants into atmosphere are 1286.6 tons per year and 12.0 gram per second. The permit is valid till August 27th 1997.

Steel casting shop, foundry shop, power plant room and engine testing room emit the majority of pollutants produced from the Tashkent Workshop. Main pollutants are dust, carbon monoxide, nitrogen oxides and sulphur dioxide.

5.2.4 Waste

The waste of ferrous and non-ferrous metals is used for the needs for the Tashkent Workshop and transferred to the reproducing plant. The oil and grease waste are sent to the oil products storage base (oil base). The glass waste is sent to glass factory. Non-ferrous metal slag is sent to the other reproduction plant. Small pieces of wood and cloth are sold to the public. Construction wastes, burned soil and slag from ferrous metals production and domestic wastes are all sent to the municipal waste dump site for domestic solid waste.

5.3 UZBEKISTAN DEPOT

5.3.1 Water supply

At present, the Uzbekistan Depot is provided with water from two artesian wells #4 and #5 which are located in the territory of the Depot.
After completing of construction and introduction into practice of new shops, the water consumption at the Depot will increase significantly and it will not match, and the two existing wells cannot fully provide water for the needs of new line of locomotive facility.

5.3.2 Wastewater

The wastewater of Uzbekistan Depot comes from water use for industrial needs and for domestic needs. Domestic and low contaminated industrial wastewater directly enters into the municipal sewage system. After processing by a local treatment facility for industrial wastewater containing oil products, treated wastewater goes into the municipal sewage system. Because of low performance of this local treatment facility, a new wastewater treatment facility is constructed. The new sewage system will begin to be operated in 1997.

5.3.3 Air pollution

There are 101 sources of emission on the territory of the Uzbekistan Depot. The main sources that cause significant emission into atmosphere are wood-working, metal-working, welding, painting, production of concrete blocks, and sand drying, polymer section, babbit section, boiler rooms and rheostat section of shunting locomotives tests. Especially, in production of concrete blocks and sand drying, the emission of sand dust into atmosphere is 31.4 % of total emission, and that of broken rocks is 13.8 % of total emission.

5.3.4 Waste management

The detail of waste management was not obtained form the Uzbekistan Depot. The majority of solid wastes is buried in the territory of the Uzbekistan Depot.

5.3.5 Working Environment

(1) Noise

There are work places where noise level exceeds the maximum allowable levels for workers.

(2) Inside air pollution

Air pollutants (carbon monoxide, nitrogen dioxide, aerosols dusts and so on) in some work places exceed the maximum allowable concentration for workers.

CHAPTER 6 CURRENT CONDITION OF UTJ

6.1 ORGANIZATION

(1) UTJ: UTJ was born in 1994, from the Central Asia Railway (CAR), and CAR had been born from the Soviet Railway Organization (SZD).

It (UTJ) has 31 subsidiary companies (total employees are 37,000) and 5 railway divisions (total employee are 46,000) under its administration and the employees are approximately 83,000 as of January 1996. The 51 % of its stocks is owned by Uzbekistan government. The chairman of UTJ is a member of Uzbekistan Government's Cabinet members and also is under the command of the Deputy Premier Rakhimov, (who is also in charge of Airways, Roads Construction, Transportation by Automobile, and Communication). UTJ's headquarters is headed by the Chairman Ermetov, with the assistance of several Deputy Chairmen. Organization chart of UTJ Headquaters is shown in Fig 6.1-1.

(2) Tashkent Workshop

Tashkent Workshop is a part of one of UTJ's 31 subsidiary companies, and is called "Uzzheldorremmash". "Uzzheldorremmash" is a workshop enterprise, which is composed of three workshops or factories, namely, Tashkent Workshop, Andijan Mechanical Workshop, and Pakhtaabad Department. Tashkent Workshop has 4 main working complexes (namely, the production complex, the social development complex, the capital construction complex, and the procurement complex) in its organization, and the main work is the repair of locomotives and railcars, and some of its work spreads to the construction, the transportation, etc. At the time of January 1996, Tashkent Workshop had approximately 2200 employees, but the number has gradually decreased to under 2000.

(3) The Uzbekistan Depot:

This depot is the only one for electric locomotives and electric rail cars in UTJ. It was established in 1978, with three branch depots of Havast, Hozikent and Tashkent. The number of employees is approximately 1280 at the time of January 1996, and the main work of the depot is the operation of locomotives and their inspections.

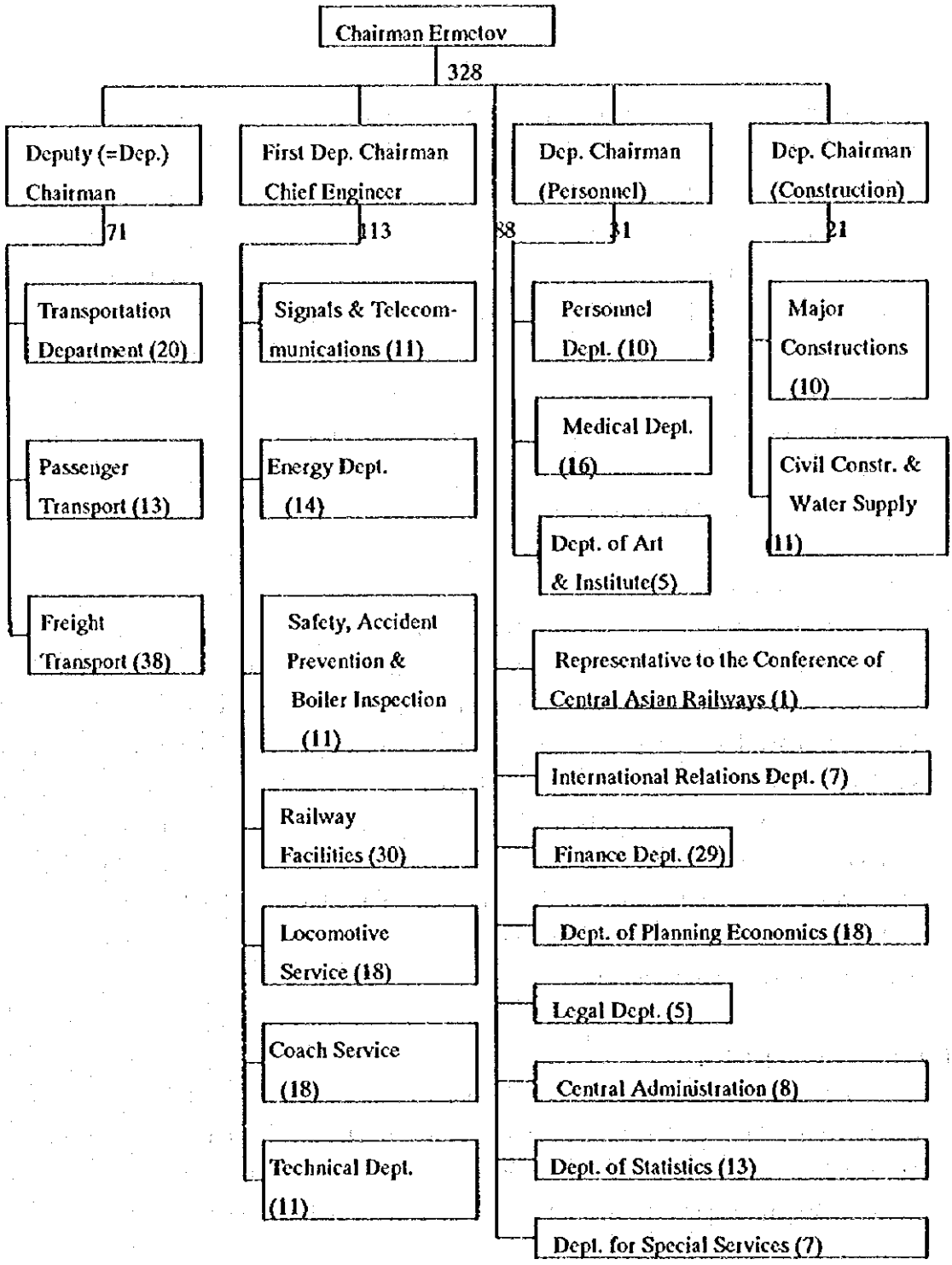


Fig. 6.1-1 Organization of UTJ Headquarters

6.2 FINANCIAL CONDITION

(1) The framework of UTJ's financial accounting system remains firmly based on that of SZD, as laid down by the Soviet Union's Ministry of Railways in 1985. This system, in common with all state-owned railways in both planned and market economies, concentrates heavily on costs and measures of output. Revenue details take up just 1½ pages of the 18-page annual report.

(2) Even though UTJ has been in existence as a separate legal entity for a little over two years, it has not yet been required to produce the kind of accounting documentation which would be more familiar to people coming from a capitalist system. As a result, Profit and Loss Accounts, Balance Sheets, and Cash Flow Statements do not exist in a format recognizable to a western accountant.

(3) Summary results for 1991-1995 are given in the following table, together with projected outturn results for 1996 and forecast results for 1997. The financial year runs from 1 January to 31 December. Actual results for 1996 are not expected to be published until March/April 1997.

Table 6.2-1 - UTJ Summary Financial Results (All Figures Sums x 10^3, Current Prices)

Description	1991	1992	1993	1994	1995	1996 Projected	1997 Forecast
Total Revenue	**1881**	**21062**	**206078**	**2475422**	**11712657**	**24773395**	**27572346**
Of which:							
Freight/Passenger	1545	18191	175469	2111815	5958190	14322933	17121882
Subsidiary Activities	334	2833	29318	315212	4101108	8324136	8324136
Miscellaneous	2	38	1291	48395	1653359	2126328	2126328
Total Costs	**1567**	**13723**	**130702**	**1014394**	**7942679**	**19513621**	**25000000**
Of which:							
Traffic Costs	1261	11340	107318	796861	4031872	12771968	-
Subsidiary Activities	306	2383	23384	217533	3910807	6741653	-
Less Financing Activities (1)	-	-	-	-	529256	3673247	-
Total Profit Before Tax	**421** (2)	**7719** (2)	**75415** (2)	**1514806** (2)	**3240722**	**1586529**	**2572346**

Source: UTJ

Notes: (1) Financing activity is the net of dividends/loan interest paid/received, and gains/losses from currency exchange.

(2) Totals do not add in source.

(4) Attention is again drawn to the fact that UTJ is predominantly a freight railway, with freight income accounting for 93.5% of 1994 traffic revenues, and 89.4% in 1995, the decrease in proportion being among other things reflective of the large increase in passenger tariffs during 1995. There is a large cross-subsidy from the freight to the passenger business.

(5) Taken as a whole, the 1995 revenues of UTJ's railway operating activities cover

costs by a factor of 145%. As with all accounts, however, care must be exercised in interpreting these figures as they both include and exclude items which a reader, used to different railway accounting systems, might assume to be absent or present.

(6) The published accounts do not provide any indication of cash flow. However, a 1995 ministerial report makes reference to a 'receivables burden' of no less than 3.4 billion Sums which UTJ was seeking financial assistance to liquidate. This suggests that customers are taking up to four months to settle their bills (longer if the problem is confined mainly to the freight business).

(7) In summary, therefore, whilst UTJ has historically had a profitable and sound financial foundation, it is today facing difficulties and challenges which will not become any easier as it adjusts to a more market-driven economy. Restructuring of the business will throw up further areas and activities which are unprofitable and which will face closure if other sources of financing such as grant or subsidy are not obtained. These problems are particularly acute in the passenger sector.

6.3 TRAIN OPERATION

Although freight transport in UTJ has largely decreased recently, freight train operation rate accounts for about 70% of the whole train operation kilometer, and passenger train operation ratio only about 30%.

Train kilometer of passenger and freight trains are as shown in Table 6.3.1

Table 6.3.1 Train Operation Kilometer (Unit;Millon)

	1991	1992	1993	1994	1995
Passenger Train	14.6	13.4	12.9	11.5	10.7
Freight Train	63.4	33.3	27.2	25.7	22.5

6.3.1 Passenger train

In the suburban sections about 150km around Tashkent, electric rail-car trains with eight~six cars are operated, and in the other sections, passenger trains with about twenty coaches.

In almost all of electrified sections, passenger trains are electric locomotives hauled, in the other sections containing some parts of electrified ones, all trains are diesel locomotive hauled.

Scheduled operating speed is low, 40~60km per hour . Almost all of passenger trains are long distance trains like international ones etc., and domestic trains are few.

As for the trains starting from and arriving at Tashkent station, fifty-one trains out of fifty-three are international trains like the one bound for Moskva at Tashkent North Station mainly handling north wards trains, and at Tashkent South Station mainly handling south wards trains, except only one international train bound for Russian territory via south courses, the other twenty-six trains are domestic ones starting from and terminating at stations in Uzbekistan territory.

6.3.2 Freight train

Main trunk lines for freight transport are Tashkent～ Buhara and Tashkent～Kokand ～Andijan lines in Fergana valley.

Heavy and long freight trains are composed of fifty- seven freight cars, but in special sections, of seventy-one cars, weighing eighty to hundred and twenty tones, and hauled by large capacity locomotives of three or two sections unit.

As a rule, they are hauled by electric locomotives in electrified sections, and by diesel locomotives in non-electrified sections. Scheduled speed is low,35 km per hour.

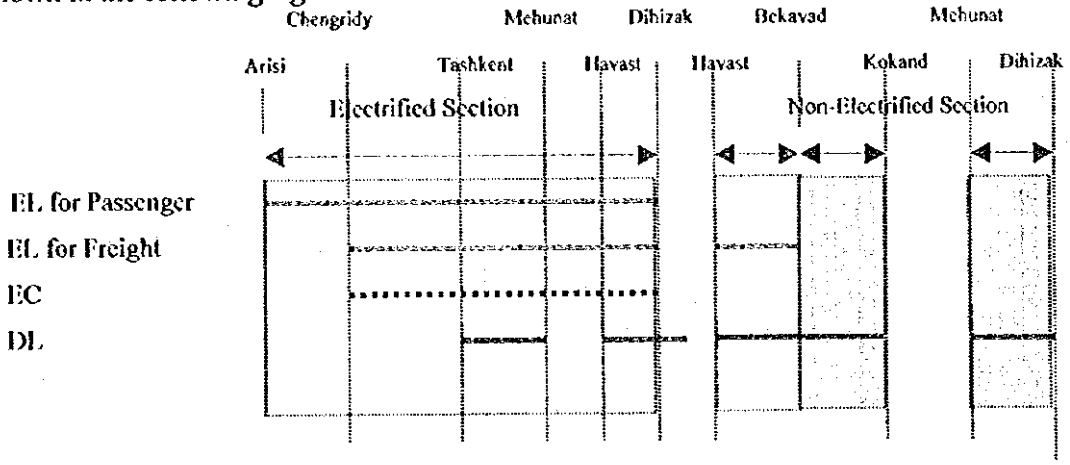
6.3.3 Number of trains by section

Number of trains by main section are shown in Table 6.3.3

Item / Station Name	Freight Train		Passenger Train						Total Train	
			Long Distance		Short distance		Total			
	Up	Down	Up	Down	UP	Down	UP	Down	Up	Down
Tashkent	5	5	18	18	15	15	33	33	38	38
Uzbekistan	23	23	18	18	14	14	32	32	55	55
Mehunat	18	18	7	7	4	4	11	11	29	29
Havst	20	20	3	3	1	1	4	4	24	24
Dihizak	20	20	15	15	0	0	15	15	35	35
Marakand	12	12	7	7	4	4	11	11	23	23
Buhara	7	7	7	7	2	2	9	9	16	16
Farab										
Mehunat	5	5	12	12	1	1	13	13	18	18
Dihzak										
Marakand	10	10	6	6	1	1	7	7	17	17
Karusi	20	20	15	15	0	0	15	15	35	35
Buhara										

6.3.4 Operating sections

Electric locomotive, diesel locomotive and electric railcar operating sections are shown in the following figure.



6.4 ROLLING STOCK

The number of rolling stock owned by Uzbekistan Railways at the end of December 1996 is as follows.

(1) Number of rolling stock by type

1) Diesel locomotive (DL)

Use	Type of loco.	Number of loco.	Number of section
Main line operation	3 ТЭ 1 0М	122	366
	2 ТЭ 1 0Л	31	62
	2 ТЭ 1 0В	76	152
	2 ТЭ 1 0М	185.5	371
	2 ТЭ 1 1 6	48	96
	2 ТЭ 1 0Ч	5	10
	ТЭЛ 7 0	15	15
	Sub – total	482.5	1,072
Shunting operation	ТЭМ 2	178	178
	ЧМЭ 3	127	127
	Sub – total	305	305
Total		787.5	1,377

2) Electric Locomotive (EL)

Type of loco.	Number of loco.	Number of section
3 ВЛ 8 0 С	27	81
2 ВЛ 6 0 К	20	40
ВЛ 8 0 С	6	6
ВЛ 6 0 К	28	28
Total	81	155

3) Electric railcar (EC)

Type of car	Number of set	Number of car
Э Р 9 Е	33	66

6.5 ROLLING STOCK MAINTENANCE

(1) Rolling stock maintenance system

1) Electric locomotive

	Period	Necessary time	Works in charge
TO-1	Daily check	0.5-1(hours)	Each station or depot
TO-2	2 days check	2-3(hours)	Nominated depot (Uzbekistan, Khavast)
TO-3	Abolished in 1995		
TP-1	30 days inspection	18-21(hours)	Uzbekistan Depot
TP-1P	60 days inspection	32-72(hours)	Uzbekistan Depot
TP-2	Abolished in 1986		
TP-3	2 years inspection	4-8(days)	Uzbekistan Depot
TP-4	4 years inspection	15(days)	Uzbekistan Depot
KP-1	6 years overhaul	Under trial	Tashkent Workshop
KP-2	12 years overhaul	Under trial	Tashkent Workshop

2) Electric railcar

	Period	Necessary time	Works in charge
TO-1	Daily check	0.5-1(hours)	Each station or depot
TO-2	2 days check	2-3(hours)	Nominated depot (Uzbekistan, N. Tashkent)
TO-3	Abolished in 1995		
TP-1	120 days inspection	18-21(hours)	Uzbekistan Depot
TP-2	Abolished in 1986		
TP-4	4 years inspection	10(days)	Uzbekistan Depot
KP-1	6 years overhaul	Under trial	Tashkent Workshop
KP-2	12 years overhaul	Under trial	Tashkent Workshop

3) Diesel locomotive for main line

	Period	Works in charge
TO-1	Daily	Each station or depot
TO-2	48 hours check	Nominated depot (Uzbekistan, Tashkent, Khavast)
TO-3	17 days inspection	Each depot
TP-1	6 months inspection	Each depot
TP-2	Abolished in 1986	
TP-3	13.5 months inspection	Nominated depot (Tashkent, Kokand, Andijan)
KP-1	4.5 years overhaul	Tashkent Workshop
KP-2	9 years overhaul	Tashkent Workshop

4) Diesel locomotive for shunting

	Period	Works in charge
TO-1	Daily check	Each depot
TO-2	48 hours check	Nominated depot (Uzbekistan, Tashkent, Khavast)
TO-3	30 days inspection	Each depot
TP-1	6 months inspection	Each depot
TP-2	Abolished in 1986	
TP-3	2 years inspection	Nominated depot (Tashkent, Kokand, Andijan)
KP-1	7.5 years overhaul	Tashkent Workshop
KP-2	15 years overhaul	Tashkent Workshop

5) Outline of entrusted overhaul to foreign countries for EL and EC

(a) Necessary transport days are 22 days/one way

(b) Necessary days and cost for overhaul

		KP-1	KP-2
Necessary days		22	24
Cost(10^3US$)	EL	140	156
	EC	109	118

Each figure shows case of 1 section for EL and 1 unit(M+T) for EC

Reference: Cost of overhaul in Uzbekistan(10^3US$)

① Assumed cost by UTJ

	KP-1	KP-2
EL	80	92
EC	68	76

② Estimated cost by Study Team

	KP-1	KP-2
EL	112	125
EC	87	94

The Study Team empirically estimated that the KP cost in Uzbekistan will be 80% of the entrusted KP cost in foreign country.

(2) Location and rolling stock in charge of workshops and locomotive depots

1) Location of workshops and locomotive depots
Location of these workshop and depots is shown in Fig. 6.5-1.

2) Repair works in charge

(a) Locomotive depot

Depot No.	Depot name	Type of rolling stock	Works in charge
ТЧ – 1	Tashkent	DL	TO-2, TO-3, TP-1, TP-3
ТЧ – 3	Kokand	DL	TO-2, TO-3, TP-1, TP-3
ТЧ – 4	Andijan	DL	TO-2, TO-3, TP-1, TP-3
ТЧ – 5	Samarkand	DL	TO-2, TO-3, TP-1
ТЧ – 6	Buhara	DL	TO-2, TO-3, TP-1
ТЧ – 7	Tinchlik	DL	TO-2, TO-3, TP-1
ТЧ – 8	Karshi	DL	TO-2, TO-3, TP-1
ТЧ – 9	Termez	DL	TO-2, TO-3, TP-1
ТЧ – 10	Urgench	DL	TO-2, TO-3, TP-1
ТЧ – 11	Kungrad	DL	TO-2, TO-3, TP-1
ТЧ – 12	Uzbekistan	DL	TO-2
		EL	TO-2,TP-1,TP-1P,TP-3,TP-4,KP-1
		EC	TO-2, TP-1, TP-4, KP-1

(b) Tashkent Workshop

Type of rolling stock	Works in charge
DL	KP-1, KP-2
EL	KP-1, KP-2 (Under trial until March 1997)
EC	KP-1, KP-2 (Under consideration)

(3) Tashkent Workshop

Figure 6.5-2 shows layout of the Tashkent Workshop.

The number of sections of diesel locomotive overhauled by the Tashkent Workshop in 1996 is as follows.

Description	KP - 1	KP - 2	Total
Uzbekistan Railways	67	47	114
Industrial Enterprise	9	5	14
Tajikistan	11	2	13
Kirgizstan	3	-	3
Kazakhstan railway	4	8	12
Total	94	62	156

(4) Uzbekistan Depot

Figure 6.5-3 shows layout of the Depot.

The number of sections of electric locomotive and electric railcar overhauled by the Depot in 1996 is as follows.

Type	TO – 3	TP – 1	TP - 1P	TP - 3	TP - 4	*KP - 1
Electric locomotive	126	339	23	21	26	6
Electric railcar	990	156	-	-	1	9

*: Conducted in Rassia

Recently, the Depot is trying to begin new business using its facilities and skill, such as production of welding wire and repair of mining diesel locomotive.

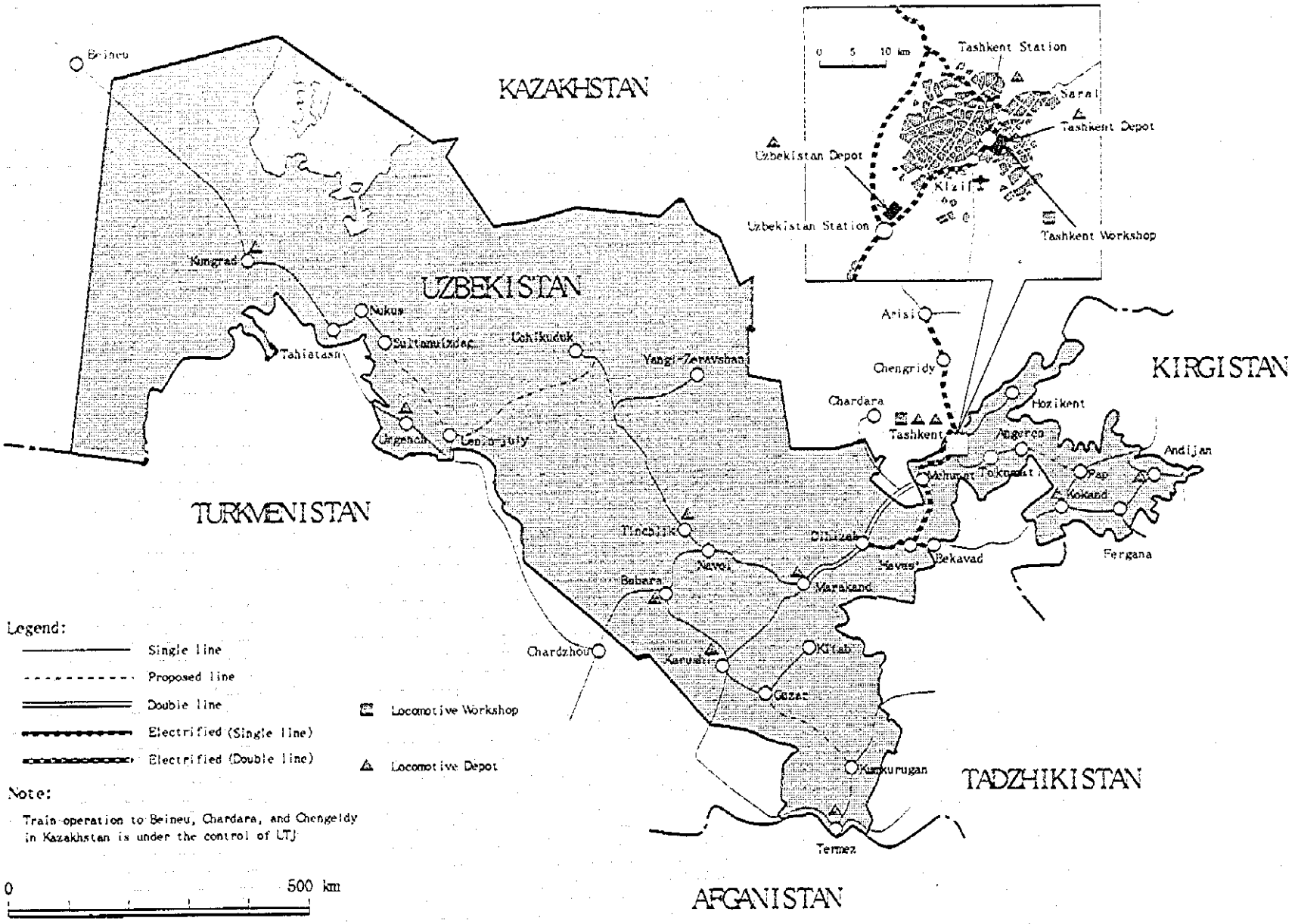


Fig. 6.5 - 1 Location of Locomotive Workshop and Locomotive Depot

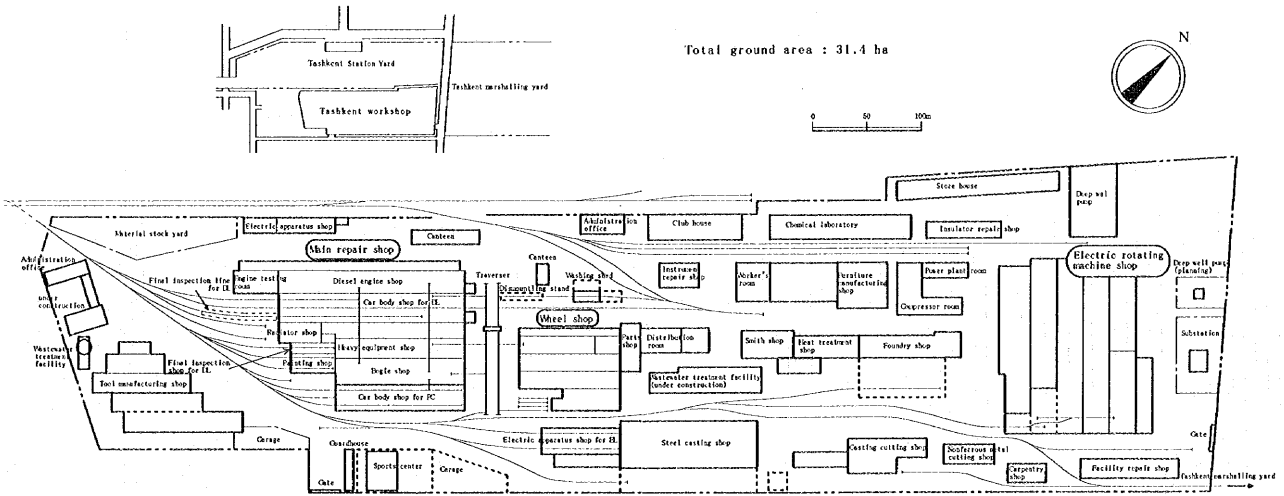


Fig. 6.5 - 2 LAYOUT OF TASHKENT WORKSHOP

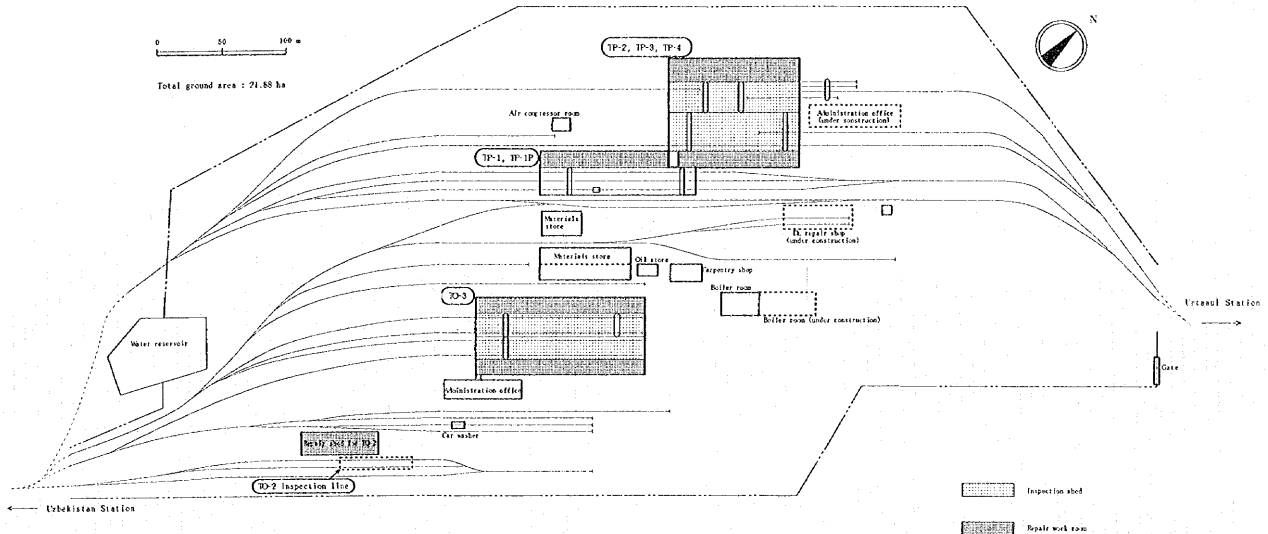


Fig. 6.5 -3 LAYOUT OF UZBEKISTAN DEPOT

CHAPTER 7 DEMAND FORECAST

7.1 GENERAL AND METHODOLOGY

(1) "Traffic forecasts are particularly difficult in countries such as those Central Asian countries where transformations are taking place and where there is still uncertainty on when economic recovery will start and which form it will take. Road transport is expected to benefit more in the event of an economic recovery than rail transport. The latter may even continue to regress on certain lines and it is unlikely that the peak levels recorded around 1989 will be reached before many years, if ever." – EBRD (European Bank for Reconstruction and Development)

(2) Although over 18 months have elapsed since that comment was written, the situation described remains true today. Considerable uncertainties exist in all countries within the Central Asian region, and to make dogmatic assertions about the shape and size of the transport industry in 2010 is folly of a high degree. Those who claim otherwise make fraudulent claims.

(3) Nevertheless, with the data that does exist, supported by professional judgments about how both the general and transport economies are likely to perform, a prediction of railway traffic-levels in the year 2010 can be attempted.

7.2 BRIEF REVIEW OF OTHER RELEVANT TRANSPORT FORECASTS

Whilst there are some differences in specifics, the general tenor of all forecasts is probably best summed up by reference to the analysts Strong and Meyer.

(1) "Many forecasters think that it will be 2005 or so before the former Soviet economies recover to 1988 production levels. The production and associated transport of primary products is likely to fall further and recover more slowly than other sectors, given the effects of moving towards market prices for energy. Some primary sectors are unlikely ever to regain 1988 levels, given high or market-determined energy and transport costs. If the transition to a market-determined system continues, there will be large shifts in mode choice, de-emphasising rail and air, and to a lesser extent water, while increasing the role of road transport. Forecasters expect road transport to reach between 22 and 41 percent of nonenergy freight transport, compared with an estimated 13 percent in 1992."

(2) "As far as rail is concerned, A market economy places greater emphasis on meeting consumer demands and those of associated light industries. This emphasis will increase the importance of serving many geographically dispersed small and medium-sized factories competing with one another to produce high-value goods. These enterprises will demand transport services of the kind road transport has been good at and rail has not. Rail traffic in the former Soviet Union in 1992 was down by 20 to 30 percent from 1990 levels, and continued to fall through 1993. Much of the lost traffic is unlikely to return. Unless services are cut back and made more responsive to users' needs, the large financial losses that first appeared in the early 1990s will continue."

(3) These comments do need to be construed, however, in the light of the slightly different economic scenario existing in Uzbekistan which is considered in Chapter 2.

7.3 ECONOMIC PROJECTIONS

(1) Economic projections for the future in Uzbekistan must be clothed in uncertainty.

(2) GDP per capita continues to decline. There is no reason to suppose that the steady increase in population will not continue at its present rate of 2.34% per annum. One of the biggest economic challenges facing Uzbekistan, therefore, will be to encompass this growing population.

(3) It seems probable that the agricultural sector will be targeted to provide the initial impetus for growth. It employs 45% of the labour force, and in cotton generates 60% of total export earnings (and 75% of all hard currency receipts).

(4) In the short-term, the policy of import substitution is likely to continue, particularly of grain, in which the president is anxious to achieve self-sufficiency (4.5 to 5 million tonnes per annum). Import substitution has already made the Republic theoretically self-sufficient in oil and gas.

(5) The artificially high official exchange rate has led to higher consumer goods imports. So far, the response has been to legislate against the importers by means of duties and the placing of hurdles in the way of currency exchange.

(6) Foreign investment has the potential to provide employment and growth, albeit not to the full extent that Uzbekistan needs. Several factors at present combine to deter foreign investors as well as domestic ones.

(7) Notwithstanding some of these problems, one should not be overly pessimistic, at least not for the longer term. Generally, service industries are likely to flourish as financial, catering and tourism sectors begin to develop. Construction, too, has potential as repair and modernization of neglected infrastructure is undertaken.

(8) Taking all of these factors into account, the most likely picture is that the decline in the economy will bottom out in 1997 and start to grow slowly again from 1998. In much the same way that the Government's step-by-step approach to reform has shielded Uzbekistan from the painful economic declines in other FSU republics, it will also act initially as a brake on accelerated growth. This will probably continue for at least five years until the Government feels sufficiently confident behind the wheel of its new car to drive a little faster. After that, a steady path of growth is assumed.

(9) Taken as a whole, however, it does not seem that the major sources of economic growth will be those sectors which rail is traditionally good at serving. The growth of rail will therefore probably be at a lesser rate than the economy as a whole.

7.4 RAILWAY DEMAND IN 2010

7.4.1 Rail Freight

(1) Analysis of historical data shows a good correlation between rail freight performance and economic performance, but one must be careful not to assume that economic performance is the only independent variable driving rail freight performance.

(2) A range of economic and transport scenarios are considered. Whichever method one uses to arrive at forecast tonne-kilometres, the most likely eventuality is that rail will lose its share of tonnage in comparison with the present day. Taking the mid-point between the low share in the 'Base' economic scenario, and the existing share in the 'Base plus 25%' scenario, it would appear that UTJ will be transporting around 23 billion tonne-kilometres in the year 2010.

7.4.2 Rail Passengers

(1) Examination of historical data yields little obvious correlation between rail passenger performance and economic performance, but this is unsurprising in view of the volatility of the environment in recent years.

(2) What should be particularly worrying for UTJ is that the sector which in theory ought to be most profitable (domestic long-distance), has shown the most dramatic declines. Conversely, domestic suburban services (normally amongst the least profitable of railway services to operate) have actually bucked the economic trend by growing quite substantially since 1991 in both passenger-numbers and passenger-kilometers. International traffic has shown growth in numbers, but decline in passenger-kilometers.

(3) Again, a number of scenarios are considered and assumptions made about likely developments. The domestic suburban service is and will remain the most buoyant. Because of its important role in conveying commuters to work, demand is likely to track the performance of the economy as a whole. Projected passenger-kilometers in 2010 are 949 million, but will be of the order of one billion by 2010.

(4) The international market has weathered the economic storm well. For the future, though, it is difficult to see on what basis it will be able to compete profitably with what will eventually be a recovering air industry. In 2010, passenger-kilometres are likely to be around 650 million, same as the projected one..

(5) Predicting the future level of domestic long-distance traffic is fraught with difficulty.

On the one hand, many of the arguments put forward to suggest a future decline in the international market apply equally to the domestic one; indeed, the statistics would seem to indicate that such decline has already firmly set in. Projected passenger-kilometer in 2010 are 774 million, but with firm management action, it should be possible to arrest this trend, and generate passenger-kilometers of around 800 million by 2010.

7.4.3 Conclusion of railway demand in 2010

Freight T-Kms and Passenger -kms are shown in the following tables.

Table 7.4.3-1 Projected Growth in Freight Tone-Kilometer At Same Rate As Economic Performance

All Modes Total T-Kms (millions) 1995	Rail Total T-Kms (millions) 1995	Economic Scenario	All Modes Total T-Kms (millions) 2010	Rail T-Kms (millions) 2010 Low Scenario (80.0% Share)	Rail T-Kms (millions) 2010 BaseScenario (86.4% Share)	Rail T-Kms (millions) 2010 High Scenerio (90.0% Share)
19579	16800	Base	27199	21759	23500	24479
19579	16800	Base+25%	29290	23592	25479	26541
19579	16800	Base+50%	31957	25566	27611	28761

Table 7.4.3-2 Projected Growth in Total Passenger Traffic

Total Rail Passengers (millions) 1995	Total Rail Pass-kms (millions) 1995	Economic Scenario	Total Rail passengers (millions) 2010	Increase over 1995 (%)	Total Rail Pass-Kms (millions) 2010	Increase over 1995 (%)
16.60	2498.0	Base	20.60	24.1	2372.8	-5.0
16.60	2498.0	Base+25%	22.06	32.9	2514.1	0.6
16.60	2498.0	Base+50%	23.64	42.4	2666.0	6.7

Summarizing clause 7.4,the following figures of railway demand in 2010 are adopted for this project

Table 7.4.3-3 Demand forecast in 2010

		2010 year (million)
Ton-Kilometer		23,000
Passenger-Kilometer	International	650
	Domestic	774
	Suburban	949
	Total	2,373

CHAPTER 8 ROLLING STOCK PLAN

8.1 TRAIN OPERATION PLAN

Necessary number of locomotives in 2010 is assumed for all Uzbekistan lines as a whole, in consideration of the current train operation, electrification plan, new line construction plan, and increase of passenger-kilometre and tonne-kilometre.

8.1.1 Preconditions

(1) All passenger trains of the following sections will be electric rail-car trains.
- Tashkent～Saral～Hozikent
- Kizil～Tukumati～Angeren

(2) Passenger trains in partial sections of Marakand～Buhara～Karushi～Marakand will be electric rail-car trains.

(3) Other trains will be electric locomotive hauled in electrified sections, and diesel locomotive hauled in non-electrified sections.

(4) The following sections will be electrified after 2005; Navoi～Uchikuduk, Nukus ～Kunkragan～Beineu, Kokand～Andijyan, new line part of Uchikuduk～Nukus

(5) New line of Angren～Pap will not be completed in 2010.
The other two lines shown in Table 4.1.1 will be completed in 2010, and all present trains via Turkmenistan territory will run on the new lines.

(6) Number of international and domestic trains will not be decreased to keep the present service level for travellers, in spite of decreased passenger-kilometre for both international and domestic transport.

(7) Passenger trains of the suburban transport in 2010, will be all electric rail-car train.

(8) Train- kilometer in 2010 is estimated, based on assumed passenger-kilometer, ton-kilometer in 2010 and the above said premise.

8.1.2 Passenger train

(1) Assumed passenger-kilometer

Table 8.1.2-1 Assumed passenger-kilometer in 2010

		1995	2010	Increase rate
Passenger-kilometer Total $\times 10^6$		2498.5	2,372.8	94.9%
Classification	International	580.0	650.3	112.1%
	Domestic	1,235.5	773.7	62.6%
	Suburban	683.0	948.8	138.9%

(2) Assumed passenger train-kilometer by hauling locomotive and Electric rail-car

Table 8.1.2-2 Assumed Passenger Train-Kilometer in 2010

(Unit; kilometer)

	Train-kilometer
EL hauled train	21,000 (11,000)
DL hauled train	3,000 (13,000)
Electric rail-car train	11,900 (11,900)

Note; The number of Train-kilometer in the case of the same electrification scale as in 2005 are shown in the parenthesis.

8.1.3 Freight train

(1) Assumed ton-kilometer in 2010

Table 8.1.3-1 Assumed ton-kilometer in 2010

	1995	2010	Increase rate
Ton-kilometer $\times 10^9$	16.8	23.0	136.8 %

(2) Estimated freight train-kilometer in 2010 by hauling locomotive

Table 8.1.3-2 Assumed Fright Train-Kilometer in 2010

(Unit; kilometer)

	Train-kilometer
EL hauled train	147,000 (79,000)
DL hauled train	21,600 (89,000)

Note; The number of Train-kilometer in the case of the same electrification scale as in 2005 are shown in the parenthesis.

8.2 ROLLING STOCK PLAN

(1) Based on the train operation plan in 2010, increase rate of passenger-kilometer and ton-kilometer in 2010, progress of electrification and new line construction, necessary number of rolling stock in 2010 is estimated as shown in Table 8.2.1

Table 8.2-1 Necessary Number of Rolling Stock in 2010 Unit; section

	Number of rolling stock		Rate to number in 1995%
	2010	1995	
EL	620 (330)	138	449% (239%)
DL	95 (385)	445	21% (87%)
EC	220 (220)	66	333% (333%)

Note 1; The number of rolling stock in the case of the same electrification scale as in 2005 are shown in the parenthesis.
Note 2; The number of shunting DL is not included.
Note 3 ; Reserved ELs & DLs in 1995 are excluded.

(2) Realization of electric rail-car trains with ten cars

At present, electric rail-car train is composed of eight cars at maximum, and mostly of six cars, but in 2010, increase of train operating frequency and electric railcar train with 10 cars will be necessary to meet the increased suburban transport.

CHAPTER 9 ROLLING STOCK MAINTENANCE PLAN

9.1 ELECTRIC LOCOMOTIVE AND DIESEL LOCOMOTIVE

Maintenance plan was settled, based on the UTJ inspection standards for locomotives as a rule, and on Japanese experiences of maintenance methods and items for principal electric equipment and apparatus.

9.1.1 Preconditions of KP-1 and KP-2

(1) Assumed number of locomotives in 2010.

Unit: section

Case \ Type		Number of locomotives			
		EL	DLM	DLS	Total
A	Electrification scale in 2005	330	385	313	1,028
B	80% electrification	620	95	313	1,028

EL : Electric locomotive
DLM : Diesel locomotive for main line
DLS : Diesel locomotive for shunting
Assumed number of DLS is the same as in 1995.

(2) Working days per year in the workshop

Weekly holidays	2 days, Saturday and Sunday
Yearly holidays	9days(Jan.1,Feb.9,Mar.8,Mar.21,Apr18,May.9,Sep.1, Oct.1,Dec.8)
The total working days per year	250 days (365 –2×52-9=252)

(3) Number of locomotives per year for KP-1 and KP-2

Number of locomotives divided by the number of inspection period is shown in the following table, as the number of KP-1 and KP-2

Case \ Type	Number of locomotives(Unit: Section)					
	KP-1		KP-2		Total	
	A	B	A	B	A	B
EL	27	52	28	52	55	104
DLM	43	11	43	11	86	22
DLS	21	21	21	21	42	42
Total	91	84	92	84	183	168

(4) Preconditions of KP-1 and KP-2.

1) Average yearly work volume.

9.1.2 Execution plan of KP-1 and KP-2.

For A Case where the number of locomotive to be repaired is lager than B Case, execution plan will be settled.

(1) Schedule of in-coming

1) In case of A: Eleven sections per three weeks.

2) Locomotive for KP-1 and that for KP-2 shops in alternately.

3) The same type of locomotive can not help shopping in successively sometimes, for fulfillment of the locomotive maintenance schedule.

4) Considering the above mentioned conditions, assume the six weeks cycle, as shown in Table 9.1.2-1.

5) Yearly locomotive in-coming schedule is shown in Table 9.1.2-2(A Case)

Table 9.1.2-1 Schedule of in-coming

Week	Working Day	Week Day	A		Week	Working Day	Week Day	A	
			Type	KP-				Type	KP-
1st Week	1	Mo.	M	2	4th Week	16	Mo.	M	1
	2	Tu.	E	1		17	Tu.	E	2
	3	Wed.				18	Wed.		
	4	Th.	S	2		19	Th.	S	1
	5	Fr.	M	1		20	Fr.	M	2
2nd week	6	Mo.	E	2	5th Week	21	Mo.	E	1
	7	Tu.				22	Tu.		
	8	Wed.	S	1		23	Wed.	M	2
	9	Th.				24	Th.		
	10	Fr.	M	2		25	Fr.	S	1
3rd week	11	Mo.	M	1	6th Week	26	Mo.	M	2
	12	Tu.	E	2		27	Tu.	E	1
	13	Wed.				28	Wed.		
	14	Th.	S	1		29	Th.	S	2
	15	Fr.	M	2		30	Fr.	M	1

M: Diesel locomotive for main line
S : Diesel locomotive for shunting
E : Electric locomotive

Table 9.1.2-2 Schedule of in-coming in a year (A case) (Unit : Section)

In-coming week \ day			1 ~ 30	31 ~ 60	61 ~ 90	91 ~ 120	121 ~ 150	151 ~ 180	181 ~ 210	211 ~ 240	241 ~ 250
Week	Week	Type	KP-1 or KP-2								
1st. 7th.	Mo.	M	2	2	2	2	2	2	2	2	2
13th. 19th	Tu.	E	1	1	1	1	1	1	1	1	1
25th. 31st	We.										
37th. 43rd	Th.	S	2	2	2	2	2	2	2	2Ⓔ	2Ⓔ
49th. Week	Fri.	M	1	1	1	1	1	1	1	1	1Ⓢ
2nd. 8th.	Mo.	M	2	2	2	2	2	2	2	2	2
14th. 20th	Tu.										
26th. 32nd	We.	S	1	1	1	1	1	1	1	1	1
38th. 44th	Th.										
50th. Week	Fri.	E	2	2	2	2	2	2	2	2	2
3rd. 9th.	Mo.	M	1	1	1	1	1	1	1	1Ⓢ	
15th. 21st	Tu.	S	2	2,	2	2	2	2	2	2Ⓔ	
27th. 33rd	We.										
39th. 45th	Th.	E	1	1	1	1	1	1	1	1	
Week	Fri.	M	2	2	2	2	2	2	2	2	
4th. 10th.	Mo.	M	1	1	1	1	1	1	1	1Ⓔ	
16th. 22nd	Tu.	E	2	2	2	2	2	2	2	2	
28th. 34th	We.										
40th. 46th	Th.	S	1	1	1	1	1	1	1	1	
Week	Fri.	M	2	2	2	2	2	2	2	2	
5th. 11th.	Mo.	M	1	1	1	1	1	1	1	1Ⓢ	
17th. 23rd	Tu.										
29th. 35th	We.	S	2	2	2	2	2	2	2	2Ⓔ	
41st. 47th	Th.										
Week	Fri.	M	1	1	1	1	1	1	1	1Ⓔ	
6th. 12th.	Mo.	E	2	2	2	2	2	2	2	2	
18th. 24th	Tu.	M	1	1	1	1	1	1	1	1Ⓢ	
30th. 36th	We.										
42nd. 48th	Th.	M	2	2	2	2	2	2	2	2	
Week	Fri.	E	1	1	1	1	1	1	1	1	

Number of locomotives						
EL		DLM		DLS		
KP-1	-2	-1	-2	-1	-2	
			9			
9						
	②				7 ⁄	
		8 ⁄		①		
			9			
				9		
	9					
		7 ⁄		①		
	①				7 ⁄	
8						
			8			
①		7 ⁄				
	8					
				8		
			8			
		7 ⁄		①		
			①		7 ⁄	
①		7 ⁄				
	8					
		7 ⁄		①		
			8			
8						
27	+28	+43	+43	+21	+21	=183

Note: In the table of "Number of locomotives", ⁄ of DLM, KP-1 means that 9 decreases to 8 and increases by 1 for DLS, KP-1. Increased number ① corresponds to 1Ⓢ in the left table. Another slashed figures mean the similar conditions.

(2) Working process of KP-1 and KP-2.

1) Process from in-coming to locomotive carbody maintenance

1stday	: Locomotive receipt, in-coming inspection
2nd and 3rd day	: De-trucking, dismounting of equipment and apparatus
4th day	: Air blow cleaning etc.
After 5th day	: Locomotive body maintenance

2) Process from finishing of locomotive body maintenance to out-going

Before out-going,

5th day	: Lowering locomotive body, mounting of equipment and apparatus etc.
Do, 4th and 3rd day	:Painting
Do,2nd day	:Final inspection
Date of out-going	:Trial run, delivery

3) Required days for locomotive maintenance in body shop for locomotive will be necessary to be decided, in consideration of the number of locomotives to be repaired and the shop area. For the instance of Tashkent Workshop in case that the number of required days for locomotive carbody maintenance is the same for both Els and DLs, it will be limited to fifteen days, due to the limitation of locomotive body number staying at the same time in that shop.

4) Schedule of KP-1 and KP-2 for EL and DL

In both A and B cases, electric locomotives and diesel locomotives numbered in 9.1.1(3) will be possible to be maintained in the following process;

EL	KP-1	22 days,	KP-2	24days,(UTJ Suggestion)
DL	KP-1	12 days,	KP-2	20days,(Actual schedule in Tashkent Workshop)

Fig 9.1.2-1 shows the schedule of KP-1 for EL

5) The inspection method for main equipment and apparatus of electric locomotive is shown in Table 9.1.2-4.

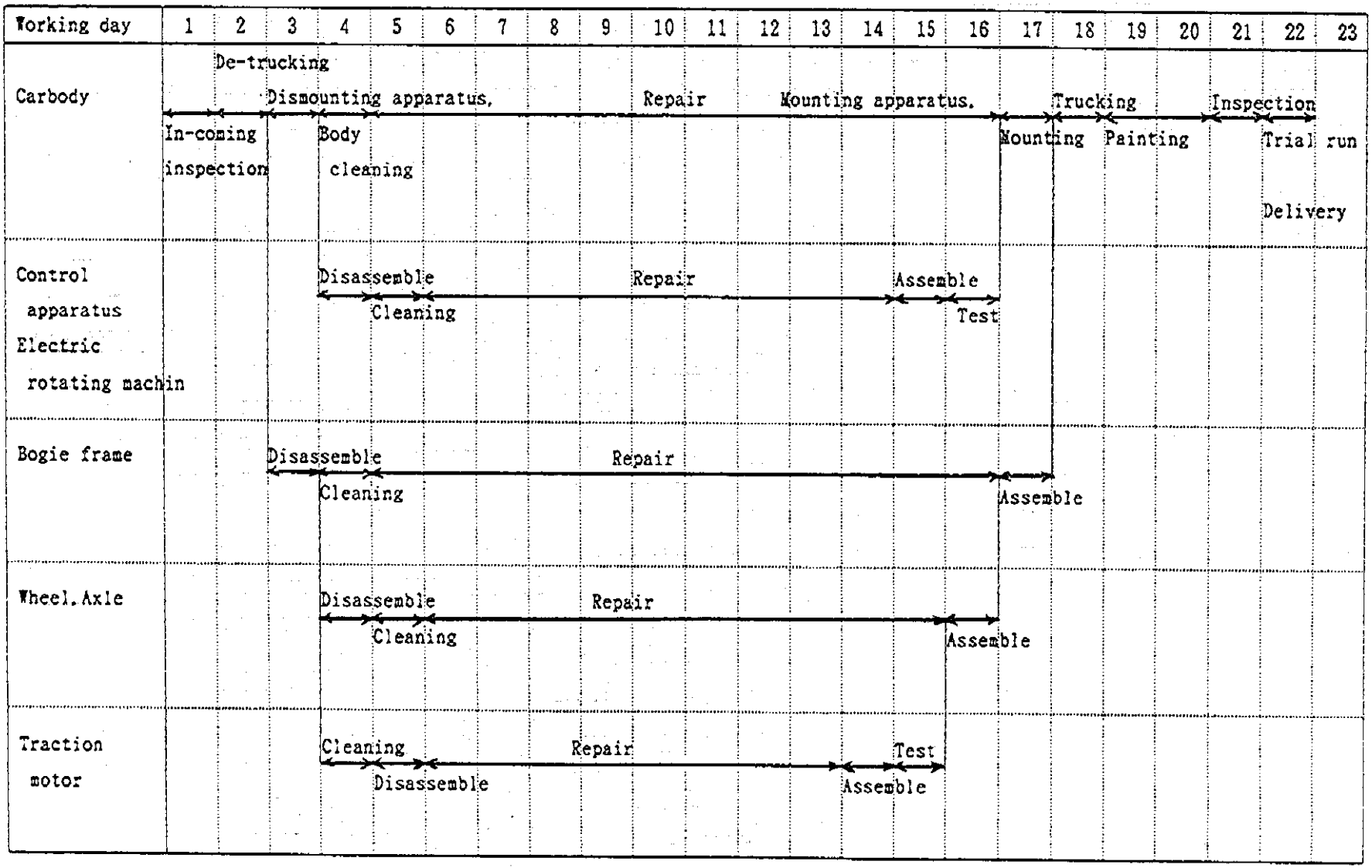


Fig. 9.1.2-1 Repair time schedule for EL KP-1 at Tashkent Workshop

Table 9.1.2-4 The inspection method for main equipment and apparatus of electric locomotive.

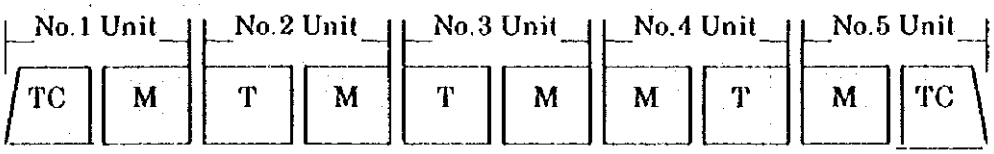
	Name of part	Check items	Method
(a)Dismounted frome locomotive	a)Pantograph	Contact pressuer. leveling of base frame. performance	Performance test
	b)Lightening arrester	Defect. performance	do.
	c)Air blast circuit breaker	Contacting state of each contacter. performance	do.
	d)Main rectifier	Performance of each stacked rectifier cell	do.
	e)Tap changer	Contacting state of each contacter. performance	do.
	f)Auxiliary rotating machine (except oil pump)	Insulation resistance. performance	Performance test. insulation test
	g)Line breaker	Contacting state of each contacter. performance	Performance test
	h)Master controllor	Contacting state of each contacter. performance	do.
	i)Electromagnetic valve	Performance	do.
	j)Safty valve	do.	do.
	k)Pressure gauge	do.	do.
	l)Coupler	Crack. performance	Performance test
(b)Dismounted from bogie	a)Traction motor	Insulation resistance. performance	Insulatione test
	b)Bogie frame	Crack. length. width. height. parallelism	Flaw detection. measurement
	c)Apparatus for braking	Length. width. air leak. performance	Performance test. measurement
(c)Mounted on locomotive	a)Main transformer	Oil leak. performance	Performance test
	b)Earth switch for protection	Contacting state of each contacter. performance	Performance test
	c)Insulator	Dielectric strength. attached dirt	Dielectric test
	d)Porcelain insulate tube for air	Dielectric strength. attached dirt	Dielectric test

Note: 1) For armature and stator, decide repair work items(rectification of commutator, re-impregnation, re-winding of coil,etc)after each insulation test.
2) For the main transformer, check the oil quantity stored in transformer body and flow quantity for cooling purposes without dismounting. In case of KP-2, inspect the insulation resistance of insulating oil.

9.2 ELECTRIC RAILCAR

9.2.1 Preconditions of KP-1 and KP-2

(1) Composition of electric railcar train



TC : Trailer car with driving cab
M : Motor car T : Trailer car

(2) Number of sections of EC per year for KP-1 and KP-2

Period of KP-1, KP-2

KP-1; 6 years KP-2; 12years

To equalize the work volume, some of newly introduced electric railcar fleets will be shopped in before their inspection date decided by the regular inspection period.

$$220\ \text{cars} / 6\ \text{years} = 36.7\ \text{cars} \fallingdotseq 40\ \text{cars}\ (10\ \text{cars} \times 4\ \text{trains})$$

(3) Preconditions of KP-1 and KP-2

1) Concurrently staying number of the railcar is one train,10 cars.

2) It is necessary to equalize the work volume as much as possible.

Necessary time of KP-2 is longer than that of KP-1. Therefore when the train enters in the workshop for KP-2, the work is busy, but for KP-1, is not so busy. In order to avoid unbalance of the work, it is desirable to divide the 10 car train into two groups, one for KP-1 and another for KP-2. For example, KP-1 is carried out for units 1, 3 and 5, and KP-2 for units 2 and 4. After 6 years, in contrast, KP-2 will be carried out to the former and KP-1will be carried out to the latter.

(4) The spare parts are not used usually. But it is necessary to use them for big repair, if any.

9.2.2 Execution of KP-1 and KP-2

(1) Schedule of in-coming

In-coming interval

$$(250\ \text{days}) / 4\ \text{trains} = 62.5\ \text{days} \fallingdotseq 62\ \text{days}$$

Staying days in the workshop 62 days

KP-1 and KP-2 are carried out for one 10 car train, and to equalize the work volume they are divided into two groups, one for KP-1 anther for KP-2. After completion of repairing for first 2 units(4 cars), repairing for the rest 3 units(6 cars) is started. Half day is necessary for air-blow, de-trucking, insertion of bogie, dismounting and mounting of electric equipment and one and half days are necessary for painting. Each process is scheduled in two days interval as shown in

Fig.9.2-1. At the first day in-coming inspection is done and, after completion of the work for the former, final inspection is carried out for 4 car train. After completion of the work for the latter, total final inspection and trial run are done for mutually connected 10 car train. Necessary days for each process are as follows.

	former 4 cars	latter 6 cars
Body, Electric equipment, Bogie	13 days	17days
Wheel sets, Traction motor	12days	16days

(2) Working process of KP-1 and KP-2

The details of inspection and repair work for the railcars are the same as those for the electric locomotive.

Because cycle time from in-coming to out going for KP-1 and KP-2 is long, dismounted equipment will be reused after completion of repair work for them. Namely, spare parts circulating system is not applied, except the case of occurrence of big repair.

Fig.9.2-1 shows an example of repair of KP-1 and KP-2.

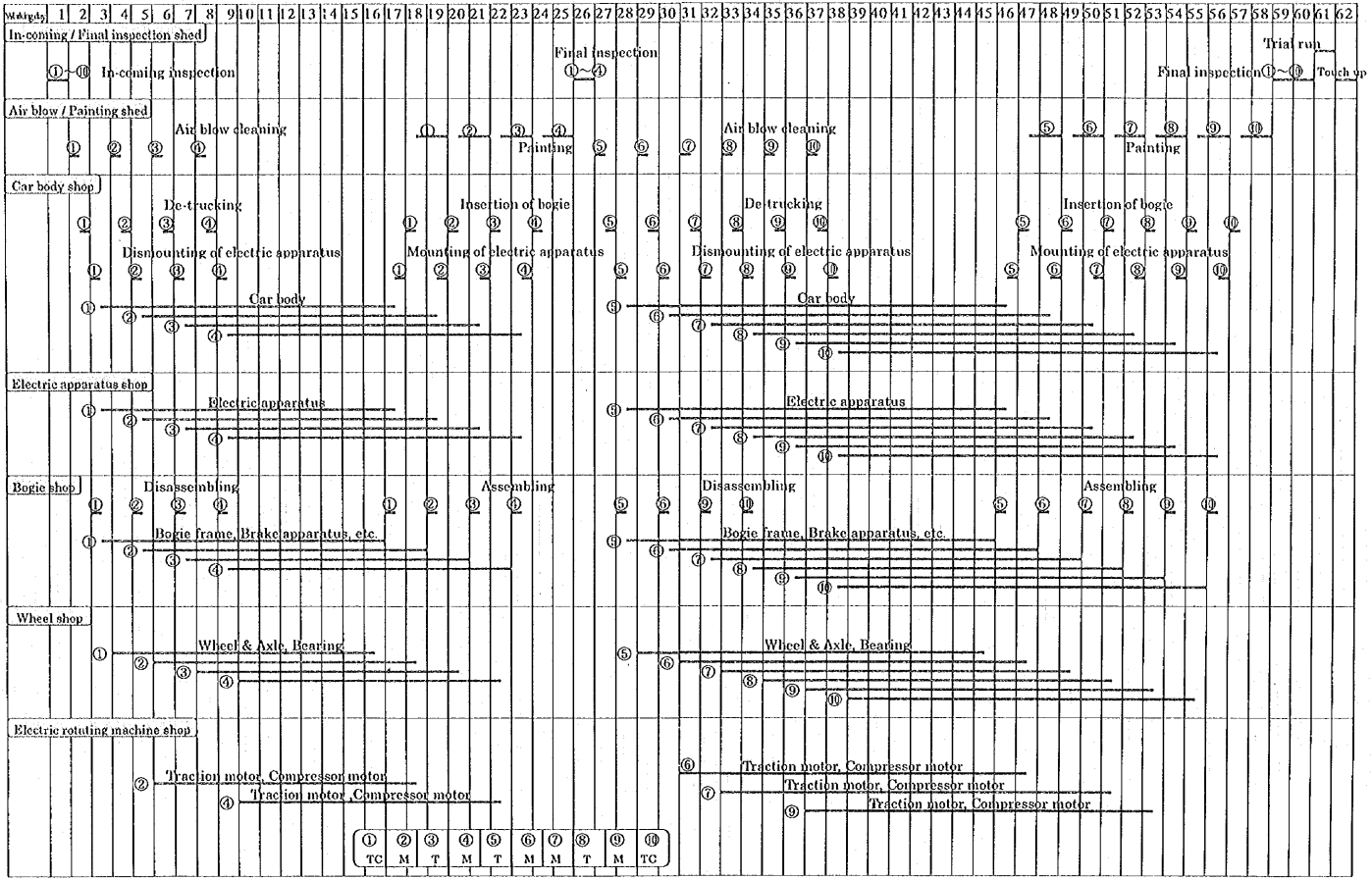


Fig.9.2 - 1 Schedule of KP-1 and KP-2 for EC

CHAPTER 10 ALTERNATIVES AND SELECTION OF THE MOST SUITABLE ALTERNATIVE FOR ELECTRIC LOCOMOTIVE REPAIR WORKSHOP CONSTRUCTION PROJECT

10.1 ALTERNATIVES

The following four alternatives are proposed.

Case 1 : Overhaul of electric locomotive (EL) is conducted in Uzbekistan Depot (the Depot) and that of electric railcar (EC) in Tashkent Locomotive Repair Workshop (the Workshop) (same as the F/S of UTJ) .

Case 2 : Overhaul of both EL and EC is conducted in the Workshop.
(Same as the additional F/S of UTJ)

Case 3 : Overhaul of EL is conducted in the Workshop and that of EC in the Depot.

Case 4 : Overhaul of both EL and EC is conducted in the Depot.

10.2 COMPARISON OF 4 ALTERNATIVES

10.2.1 Precondition

(1) Based on the result of demand forecast, the review on new line construction plan and electrification plan, and the study on train operation plan, number of rolling stock in 2010 and their number per year of KP-1 and KP-2 are shown in Table 10.2.1-1. In consideration of development of electrification, the number of rolling stock in 2010 is calculated for two cases; electrification length remains at 2005 year's plan or electrification is accomplished in 80% of total line length.

(2) The number per year of KP-1 and KP-2 in 2005 year's electrification plan scale is larger than that in 80% electrification scale of total line length. Therefore, the comparison of four alternatives is made on the 2005 year's electrification scale.

Table 10.2.1-1 Number of Rolling stock in 2010 and Their Number per Year of KP-1 and KP-2 (Number of Section)

		DL	EL	DL+EL	EC	
UTJ F/S	Number of rolling stock	863	420	1,283	270	
	Number per year of KP-1 & KP-2	160	78	238	50	
JICA F/S	Number of rolling stock	698	330	1,028	220	2005Year's Electrification Scale
		408	620			Electrification Scale in 80% of Total Line Length
	Number per year of KP-1 & KP-2	128	55	183	40	2005Year's Electrification Scale
		64	104	168		Electrification Scale in 80% of Total Line Length

Remarks: Number of DL includes number of shunting DL (313).

10.2.2 Items for comparison and examination

The following items for comparison are examined.

(1) Land restriction

The Depot locates in the suburbs of Tashkent City, having wide vacant area adjacent to the present building for repair work.

In contrast, the Workshop locates in the center part of the city and is cramped, but has adjacent available area warranted by the City authority.

It is adjacent to Tashkent Station yard and convenient to do shunting and related works of in-coming and out-going rolling stock for repair.

(2) Environmental aspect

1) Water supply: At present, the pumping rate at the Depot is similar to that of the Workshop. In future, the water demand of the Depot will increase and the Depot will need a new installation of water supply system. After a new EL(EC) Repair Workshop is constructed, the water demand of the Depot will be increase for the cases 1, 3 and 4, and the increase of water demand for the case 4 is the highest. The water demand of the Workshop will not change or decrease a little for the case 2. For the other cases, the water demand will decrease. The case 2 is the best.

2) Wastewater: In the Depot, a new wastewater treatment facility will be operated in 1997 in order to eliminate oil product from the wastewater. In the Workshop where the wastewater has much more oil products than in the Depot, a new wastewater treatment system, which has the similar system to that in the Depot and a filter system in order to reduce oil products, will be operated in 1999. After a new EL(EC) Repair Workshop is constructed, the discharge of the wastewater containing oil products will increase for the cases 1, 3 and 4 in the Depot, and the increment will be highest for the case 4. Because the repair work of DL will be reduced and will be replaced with the repair work of EL(EC), the discharge of the

wastewater containing oil products in the Workshop will increase a little but the concentration of oil products in the wastewater will decrease for the case 2. In the other cases, the discharge of the wastewater will decrease and the decrement is the highest for the case 4. It is difficult to say which of the four cases is the best.

3) Air pollution: In the Workshop, the foundry shop and relating facilities emit air contaminants such as dusts and CO. In the Depot, the process of concrete block production and boilers emit air contaminants such as dusts. The air pollution in the Workshop is more serious than in the Depot. After a new EL(EC) Repair Workshop is constructed, the increment of air pollutants' emission will be small. In this respect, the case 4 is the best.

4) Wastes: In the Workshop, the separation and reuse of wastes are well done. Wastes ,which are not reusable, are sent to the municipal final disposal place. In the Depot, wastes are not separated well. Combustible wastes are incinerated in a pit and wastes are buried there in the Depot. After a new EL(EC) Repair Workshop is constructed, the quantity of wastes will increase for the cases 1, 3 and 4 in the Depot, and the increment will be the highest for the case 4. Because the repair work of DL will be reduced and will be replaced with the repair work of EL(EC), the quantity of wastes in the Workshop will increase a little for the case 2. In the other cases, the quantity of wastes will decrease and the decrement is the highest for the case 4.
It is difficult to say which of the four cases is the best.

(3) Power supply

As for power supply, such as electricity, compressed air and steam etc. necessary to rolling stock maintenance work, no new facilities to be installed is needed and there is no difference between the Depot and the Workshop.

(4) Diversion of skilled workers to EL, EC inspection work.

As overhaul of DL is conducted in the Workshop, it has a large number of skilled workers and the quality of work will partially change from that of DL to that of EL.
So the Workshop is advantageous for the workshop construction in both quantity and quality of workers.

(5) Area of working sites

Comparison is made on the difference between necessary area and available one already in use, namely additional area to be newly prepared. The Workshop has much wider available area than the one the Depot does.

(6) Facilities and equipment

Comparison is made on the difference between necessary quantity of additional ones to be installed. Roughly speaking, no facilities and no equipment for overhaul of rolling stock is installed in the Depot, as overhaul of EL and EC is not conducted there.

(7) Rough construction cost

In Case 3, installed facilities and equipment in the Depot will be operated

inefficiently, because the work volume for overhaul of EC is small.

Items for comparison and the examined results for four alternatives are shown in Table 10.2.2-1.

10.3 SELECTION OF THE MOST SUITABLE ALTERNATIVE

(1) In comparison and overall evaluation of four alternatives, the Workshop is preferable for construction of electric locomotive repair workshop.

(2) The workshop construction plan is made on the condition that KP-1 and KP-2 of EL and EC are conducted in Tashkent Workshop.

Table 10.2.2-1 Items for comparison and the examined results for four alternatives

Item for comparison \ Case				1	2	3	4
Land restriction				△	△	△	○
Environmental Problems	Water supply			△	○	△	△
	Wastewater			○	○	○	○
	Air pollution			△	△	△	○
	Waste			○	○	○	○
Power Supply	Electricity			○	○	○	○
	Compressed air			○	○	○	○
	Stem			○	○	○	○
	Gas			○	○	○	○
Diversion of Skilled Workers				△	○	△	×
Workshop Area(m^2)	Necessary			24,844	22,180	23,760	20,830
	Available		Depot	7,344	—	85,44	85,44
			Workshop	10,000	20,020	12,180	—
			Sub Total	17,344	20,020	20,724	8,544
	To be prepared			7,500	2,160	3,036	12,286
Facilities and Equipment (set)	Necessary			506	394	483	367
	Available		Depot	—	—	—	—
			Workshop	114	162	113	—
			Sub Total	114	162	113	—
	To be installed			392	232	370	367
Construction Cost ($\times 10^6$ yen)	Building	Construction		450	129	182	737
		Reconstruction		191	225	228	94
		Sub Total		641	344	410	831
	Civil & Track			291	121	140	284
	Machinery, Transportation equipment			5,771	2,863	5,508	5,397
	Utility facilities			52	26	47	50
	Electric facilities			93	47	86	92
	Sub Total			6,776	3,411	6,190	6,654
Order of Ranking				4	1	2	3

Note ○ :Advantageous △ :A little advantageous × :Disadvantageous

HAPTER 11 ELECTRIC LOCOMOTIVE REPAIR WORKSHOP CONSTRUCTION PLAN

11.1 FUNDAMENTAL CONDITION FOR WORKSHOP DESIGN

(1) Utilize the actual machinery, facilities, equipment and available area in the workshop shown In Fig 11.1-1 as much as possible.

(2) Improvement of maintenance work level shall be taken into consideration in installation or replacement of machinery, facilities and equipment.

(3) Machinery, facilities and equipment to be installed shall be commonly used for maintenance work of both EL and EC, as much as possible.

(4) Measures for environmental problems shall be considered, as the occasions demand.

(5) Catenary over track lines adjacent to the workshop shall be installed for trial run of out-going EL and EC.

11.2 WORKSHOP DESIGN

11.2.1 Workshop layout

Fig 11.2.1.-1 shows the layout of whole workshop

(1) Body shop for Locomotives

Inspection of EL is planned to undergo at car body shop for DL, as DL are decreasing in number, and repairs of coaches presently being carried out at the body shop is planned to do at other location, resulting in room becoming available for inspection in the shop.

Fig. 11.2.1-2 shows an arrangement of locomotives for inspection and repairs. It is possible to do maintenance on 11 locomotives at the same time with enough room for 2 locomotives for lifting and 2 locomotives for lowering.

(2) Body shop for EC

The car body shop for PC will be available for the repair of EC. There are two types of moving cars using machinery. One is by overhead travelling crane and the other is by lifting jack. The former is superior to the latter from view point of efficiency for shifting cars. The height of the present shop, however, prevents the above mentioned crane from being installed. To remold the shop to accommodate the overhead travelling crane will be too expensive. Therefore, the lifting jack will be introduced instead. It is possible to do maintenance on 6 ECs at the same time with enough room for 1 EC for lifting and 1 EC for lowering.

(3) Air blowing shed for EC

Cleaning before inspection and repairs of EC will be made by air blow, because there are many kinds of electric components and no oily adhesion with car-bodies.

The air blow cleaning shop for EC is planned separately from the present cleaning facilities for DL. The present tool manufacturing shop will be equipped with the air blow cleaning booth for EC with necessary facilities. Air blow cleaning for EL is planned to share with DL at the present cleaning shop for DL in the shunting area, partially remolding its facilities..

(4) Painting shed for EL/EC

The present tool manufacturing shop will be converted to painting shop with necessary facilities.

Painting of a carbody requires 2 days. In case of the EC, four or six cars occupy the shop for 8 or 12 days in succession for their repairs. In the meantime, painting of EL cannot be executed.

In order to paint EC and EL successively, two sets of painting facilities shall be installed, and operated in Tact System (a sort of assembly-line operating system for mass production). In four hours painted bodies move to next position in turns, making it possible that maximum 2 cars can be painted in one day.

(5) Final inspection shed for EL

Final inspection of EL will be carried out in the present electric apparatus shop for EL.

One track in the final inspection shed is used solely for the inspection of EL before out-going. In order to carry out inspection for EL with 3 sections, it is necessary to install catenary which length is equal to that of locomotive with 3 sections.

A transformer of 25 kv is used as the main power source which is used in common with the following item (6).

(6) In-coming/final inspection shed for EC

EC undergo in-coming inspection and the final inspection after completion of repairs, for unit or train set. For this, an inspection shed of 10-car length will be needed. The shed will be provided adjacent to the wall side of the existing steel casting shop, installing catennary of necessary enough.

In the test for a train-set, inspection of high voltage circuit and running test at low speed are being planned.

(7) Bogie shop

By transferring repairs of PC to other location, there will be ample room for all types of bogies to be repaired.

(8) Wheel shop

The present wheel shop has sufficient capacity for inspection and repairs of wheels ever since the establishment of the shop. Wheels of all sorts of cars can, therefore, be inspected and repaired.

(9) Electric rotating machine shop

The present capacity of the motor repair shop has had sufficient room since the establishment of the shop like the wheel inspection shop. All kinds of electric rotating machines can be inspected and repaired in the same way as before.

(10) Electric apparatus shop

The inspection shop for small-size electrical apparatus is to move to the shed on the south side of final inspection shed for EL because it is narrow and unsuitable for work of electric apparatus. Exclusive machinery for maintenance of EL and EC are to be newly supplied. In order to increase inspection capability, testing apparatus are strengthen in quality and quantity.

(11) Trial run track

For the sake of test run of EL and EC after completion of repairs, catenary is installed for 1.5km-length of track adjacent to the shop of Tashkent Station side.

(12) Transportation and motive power etc.

1) Due to layout of the inspection and repair facilities, EC is to move from one shop to another with much complexity. In order to avoid complexity, it is proposed to introduce a shunting engine available both on rail and on road.

2) A traverser is newly furnished for common use of DL, EL and EC. Approaching tracks and necessary facilities around the traverser are to be improved.

(13) Building

1) Inspection pits have to be constructed with enough distance between footings of the building and pits, as they are constructed in the existing building for maintenance..

2) In-coming/final inspection shed for EC to be newly constructed is planned to be of steel structure and to have expansion joint in the longitudinal direction.

3) In order to secure working safety, guide sign posts and colour posts are arranged.

(14) Track/Civil engineering

1) Formation level

The formation level is 600 mm below the top of rail. The sub-grade is replenished with soil of good quality after removing surface soil of 500 mm in depth.

2) Track center distance

The minimum distance between track centers is five meters or more.

3) Track structure

The track structure is composed of ballast with crushed stones, PC sleepers, rails of 60 kg/m and the ballast depth is 300 mm as standard.

4) Turnout

The turnout is a type of No. 10, and is operated by a switch with a weight.

Quantities of settlements and facilities are outlined as following Table 11.2.1-1.

Table11.2.1-1 Quantities of Work

Building			Civil Work	
Incoming/final inspection shed for EC	New building	2,160 m^2	Rail length	1,880 m
Body shop for EC	Improvement	2,880 m^2	Sleeper	800 pcs
Final inspection shed for EL	Improvement	1,728 m^2	Turnout	3 sets
Electric apparatus shop	Improvement	720 m^2	Ballast	1,000 m^3
Painting shed for EC, EL	Improvement	1,944 m^2		
Air blowing shed for EC	Improvement	540 m^2		

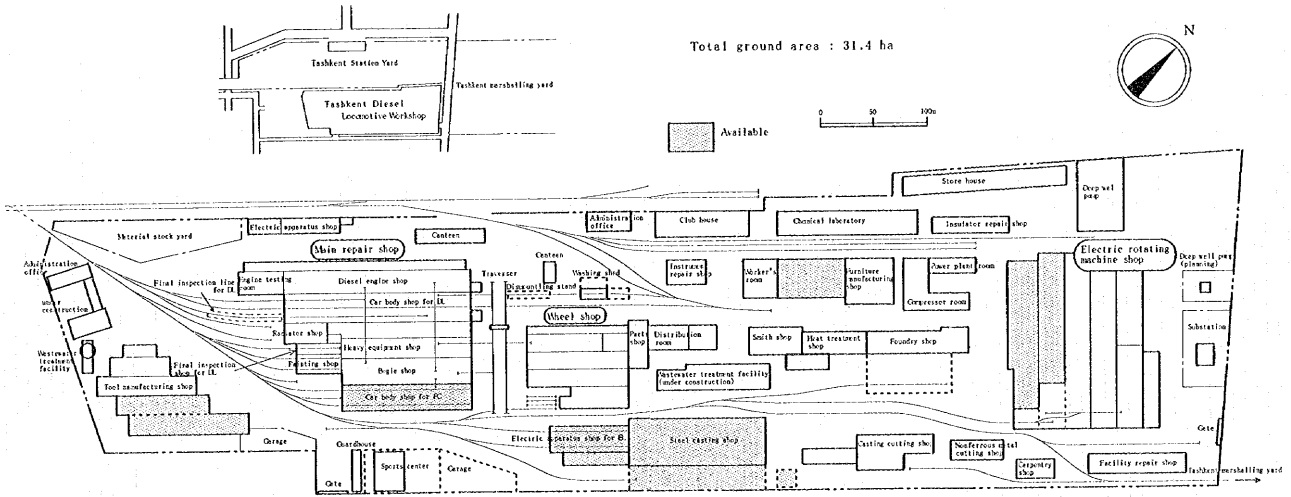


Fig. 11.1-1 LAYOUT OF TASHKENT WORKSHOP(Available parts for construction of electric locomotive repair workshop)

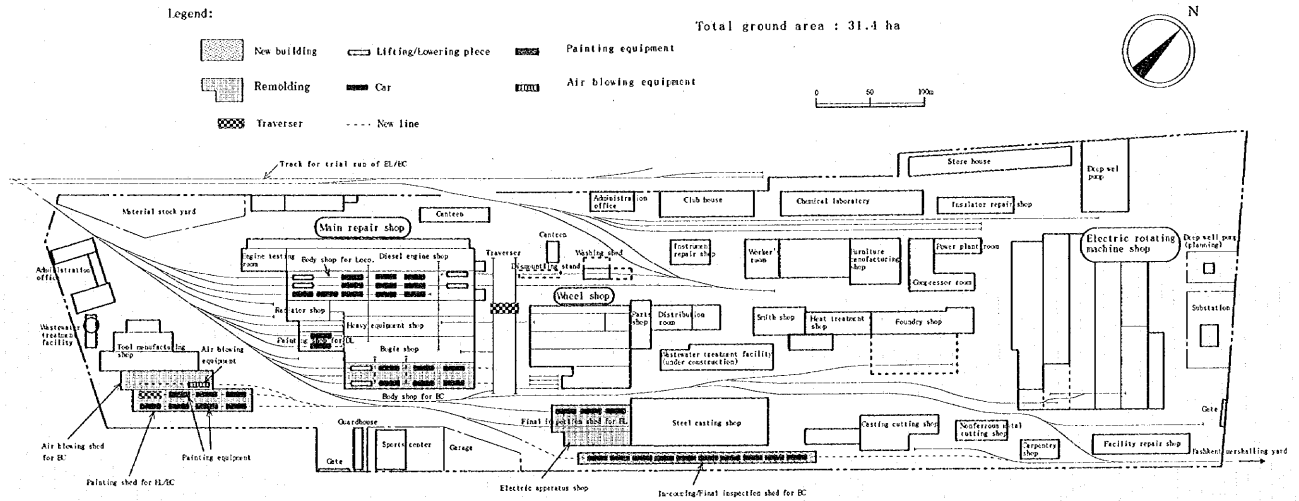


Fig. 11.2.1 - 1 LAYOUT OF TASHKENT Workshop

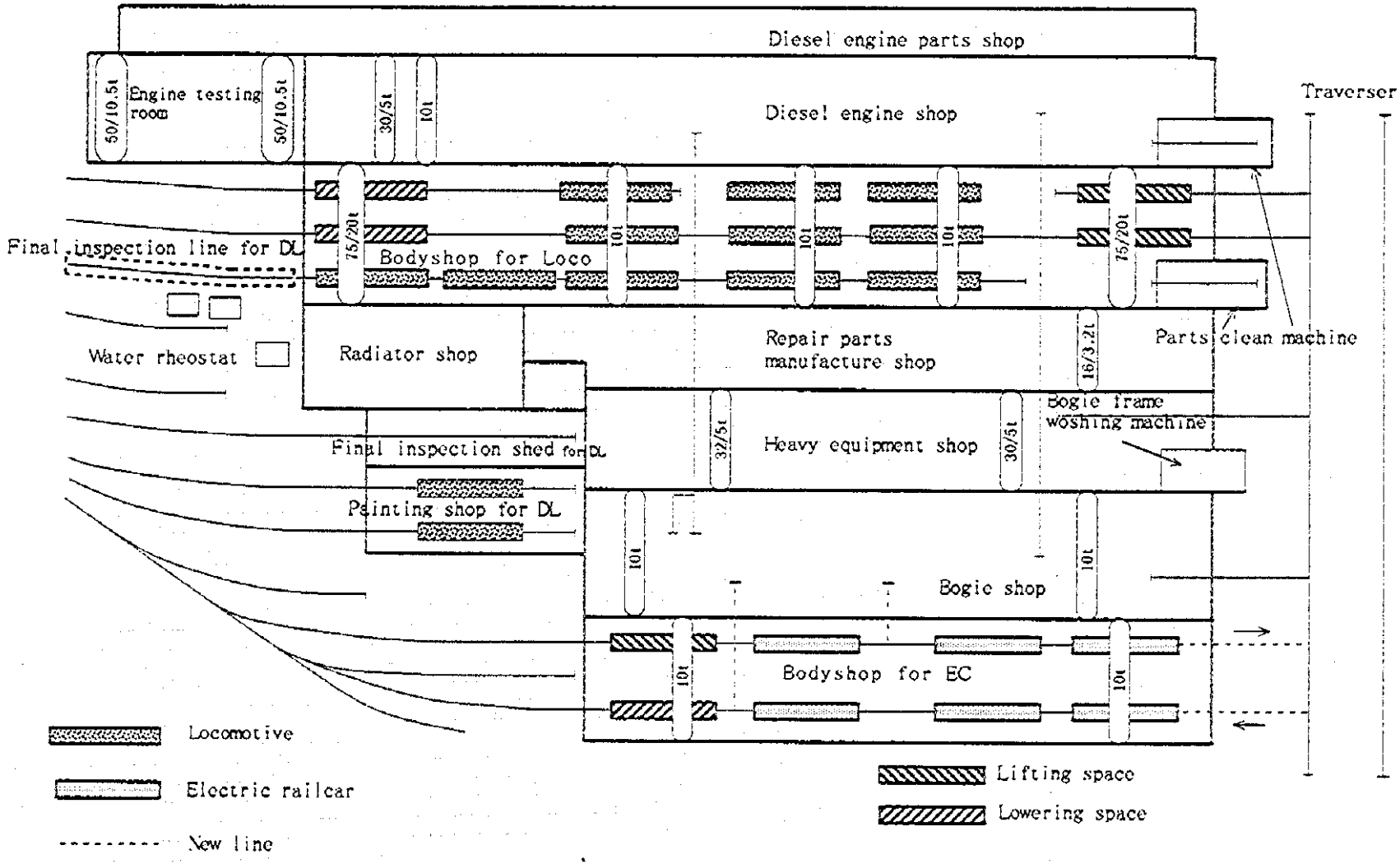


Fig. 11.2.1 - 2 Main Repair Shop

11.2.2 Rough design for construction of electric locomotive repair workshop

(1) Building

1) The existing car body shop for PC will be converted to body shop for EC. A part of the body shop for EC (about 300m^2) will be remodeled along with installation of new lifting jack for inspection.

2) The present electric apparatus shop for EL will be converted to final inspection shed for EL with remodeling adding double-pits (one track for three sections) newly established. The adjacent vacant building will be used as a repair shop for small-sized electric parts and so on.

3) The in-coming and final inspection shed for EC should be of steel structure accommodating 10-cars.

4) The present tool manufacturing shop will be remodeled for painting and air blowing cleaning shop adding side drain for painting and double pits for air blow cleaning.

(2) Civil and track work

1) A track will be branched off from Tashkent workshop yard into the final inspection shed for EC.

2) A track will be branched off from Tashkent workshop yard to the painting and air blowing shop for EC as well.

3) Pavement for crossing the branch track should be done at the same time.

Name of Work	Quantity
Indoor Track	490 m
Outdoor Track	450 m
Railroad Crossing Pavement	6 set
Inspection Pit	224 m
Turnout	3 set
Turntable Pit	2 set

(3) Machinery

Quantity of principal machinery and equipment to be used for inspection and repairs of EL and EC is shown below:

Working Place	Quantity (Number or Set)	
	Existing Machines	Machines to be installed
Air blowing shed for EC		4
Painting shed for EL/EC		31
In-coming/final inspection shed for EC		7
Final inspection shed for EL		8
Body shop for EC	8	46
Body shop for EL,DL	8	66
Bogie shop	44	18
Wheel shop	31	5
Electric rotating machine shop	64	12
Electric apparatus shop for EL,EC,DL	7	24
Transportation, motive power and etc.		11
TOTAL	162	232

(4) Utility facilities

Name of Work	Quantity
Steam pipe line	1
Compressed air pipe line	1
Water-supply pipe line etc.	1

(5) Electric facilities

1) Catenary and a transformer with the capacity of 25kv will be install for the in-coming / final inspection shed for EC and final inspection shed for EL.

2) Catenary over the track line adjacent to the shop will be installed for trial run of out-going EL and EC.

3) Lighting facilities for an inspection will be done around the pits of inspection and finishing.

Name of Work	Quantity
Power receiving facilities	1 set
In pit lighting	1 set
Overhead Catenary Line	1790 m

11.2.3 Pollution control

(1) The present wastewater treatment facility doesn't function well for reducing oil products from wastewater. The completion of the new wastewater treatment facility, which is under construction, is one of the most important projects planned for the Tashkent Workshop. It is said that it will be completed by 1999.

(2) It is estimated that:
- the water consumption directly related to the repair work for locomotives will be in proportion to the number of DL, EL and EC to be repaired in Tashkent Workshop(58% increment of the number of locomotives to be repaired in the year 2010 (the same level of electrification in 2005) from the level of the year 1995);
- the other industrial and domestic water consumption will be constant; and
- the new wastewater treatment facility will be completed and then treated water will be partially reused.

As a result of this, the total water consumption will be below the present level. Therefore, the groundwater consumption will also decrease, and then the possibility of ground subsidence will be small.

(3) An air blowing shed is newly prepared in this project. Dusts which occur in the process of air blowing must be eliminated from exhaust gas of this shed with a baghouse filter.

(4) A painting shed is also newly prepared in this project. Paint-aerosols and evaporated solvents, which are produced in the process of painting, are exhausted as air pollutants.
A wet-scrubber is used to eliminate these air pollutants from the exhaust gas.

(5) The majority of dusts and carbon monoxide which is exhausted in the Tashkent Workshop occurs from the foundry factory and related facilities. The concentration of dusts on the border of the Tashkent Workshop exceeds the maximum permissible concentration. This problem should be resolved by UTJ, because this project has no relation with this problem. Measures toward the emission of dust and carbon monoxide from the foundry factory are:

- Processes or materials are changed to reduce these pollutants;

- Air pollutants are reduced with equipment which removes dusts from flue gas, such as a filter or an electrostatic precipitator. Furthermore carbon monoxide is completely combusted and dusts are removed with the same type of equipment; or

- The new factories are constructed with measures towards air pollution or are translocated.

Appendix 11.2.3-6 " Removal of Dust and CO from the Flue Gas of Cupola and Electric Furnace" and Appendix 11.2.3-3 " Equipment for the Removal of Dusts from Exhaust Gas" may be useful information.

(6) Glass, metals, oil products, wood, and cardboard are recycled in the Tashkent Repair Workshop. But 22 tons of linoleum, 51 tons of paper, 59 tons of artificial leathers, 61 tons of glass wool, 26 tons of rubber, 65 tons of cloth, 600 tons of slug, 1000 tons of domestic wastes, and 500 tons of construction wastes per year are sent into the municipal final disposal place. Now the reduction of wastes is demanded. The following methods are recommended:

- biological treatments

- high temperature furnace with which the reduction of paper, cloth, domestic wastes and sludge is done (But eliminating chlorinated organic compounds from wastes to be combusted with the furnace is necessary in order to prevent from producing dioxins).

(7) Conclusion

1) The following measures against environmental pollution will be taken in this project:
   - The removal of dust from the exhaust gas of the new air blowing shed.
   - The removal of paint-aerosol and solvents from the exhaust gas of the new painting shed .
   - The removal of wood dust from the exhaust gas of EC carbody shop.
   - Others

2) The following measures against already existing environmental pollution will be recommended to be done by the Tashkent Workshop as soon as possible:
   - The completion of the new wastewater treatment facilities which is being constructed;
   - The solution on the air pollution caused by the foundry shop and its relating facilities.
   - Others

3) It is recommended that the Tashkent Workshop will do the minimization project on wastewater, wastes and air pollution and will reduce the consumption of natural resources such as water, fuels and so on.

11.2.4 Execution plan

(1) Execution plan of workshop construction

A schedule of workshop construction is as shown in Fig. 11.2.4-1 on the assumption that, commencement of construction work would be in the year 2000 and completion in 2001.

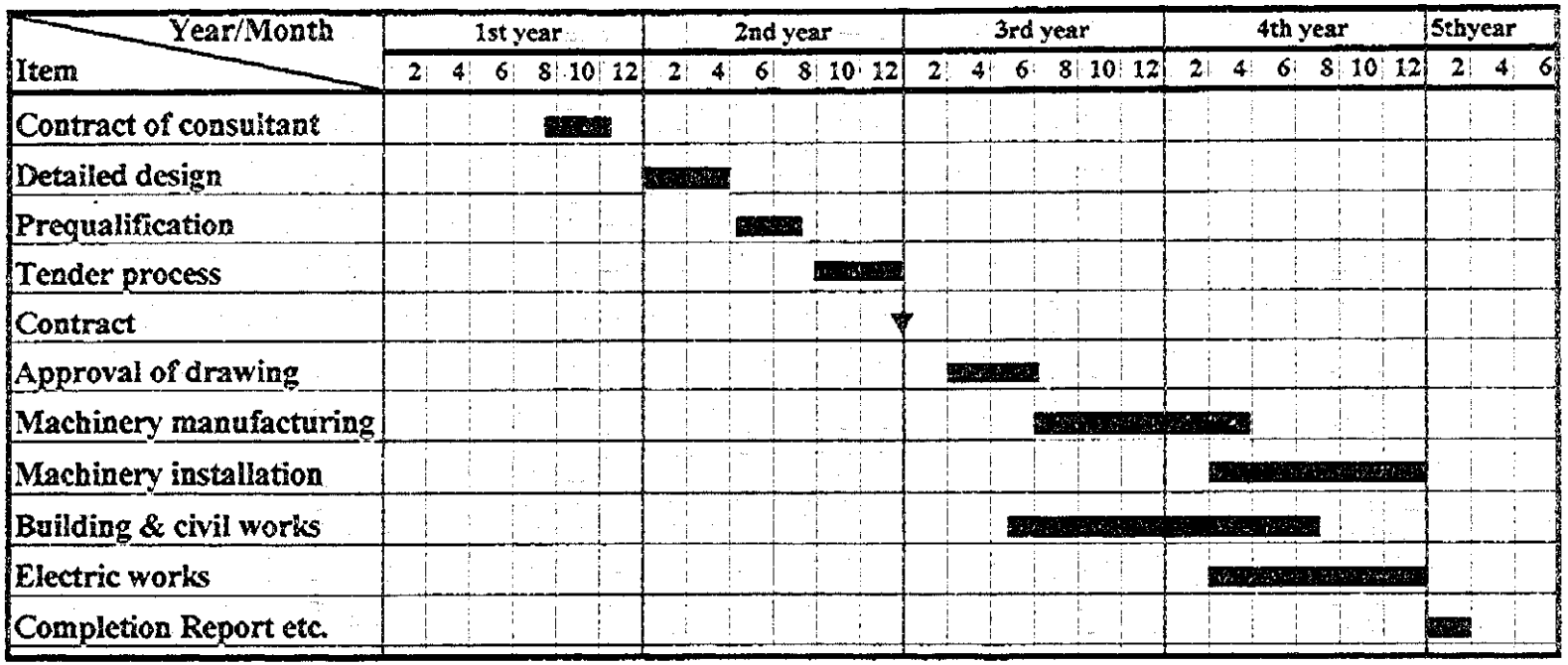


Fig 11.2.4-1 Execution plan of workshop construction

(2) Temporary measures of daily maintenance work during construction period

1) In the period of remodeling traverser (2～3 months), as it is impossible to move carbodies directly to the lifting space, cars are conveyed, in the Fig 11.2.1-1 Layout of Tashkent Workshop, from the left side of the lowest line of the body shop for locomotive to the present repair space of entrance side that can accommodate two cars.
The lifting space can be used for storage of car-bodies.

2) In the period of remodeling traverser (2～3 months), as cars are unable to move in the washing shed, the following measures shall be taken;
(a) Temporary cleaning space will be provided in a tent on the left side of the body shop for locomotive in the Fig 11.2.1-1. Cleaning shall be done by manual work for the time being.

(b) Washing will be made with a portable steam generating apparatus (Chemical fluid can be used).

(c) Temporary drainage is prepared.

3) In the period of remodeling traverser(2～3 months), it is impossible to transfer wheels from the bogie shop to the wheel shop by traverser, trucks or battery cars shall be substituted for it..

4) Work has to be suspended when the electrical apparatus repair shop removes, and so installation of an inspection and repair facility for machinery of EL and EC has to be completed before starting the work
In carrying out repairs of DL, it is necessary to keep the sufficient spare parts in hand.

5) Prior to starting remodeling, equipment to be removed in related shops should be moved away.

6) During construction of new track leading to the new painting and cleaning sheds, road traffic in the workshop compound should not be interfered with.

7) Two tracks will be installed for moving bogies between the carbody shop for EC and the bogie shop transferring machinery on the bogie shop side should be made, if necessary.

11.3 ESTIMATION OF CONSTRUCTION COST

Construction cost both in foreign and local currency portion is estimated as follows:

Table11.3-1 List of Construction Cost (unit: ¥1,000)

Work Item			Foreign Currency	Local Currency	Total Cost
Construction of Workshop	Building		——	354,000	354,000
	Civil		23,000	98,000	121000
	Machinery	General	1,900,200	81,650	1,981,850
		For environmental problems	723,300	16,700	740,000
	Utility Facilities		——	26,000	26,000
	Transportation equipment		134,500	6,650	141,150
	Electric Facilities		15,000	32,000	47,000
	Sub Total		2,796,000	615,000	3,411,000
Consulting Service (10%)			341,000		341,000
Total			3,137,000	615,000	3,752,000
Contingency (5%)			157,000	31,000	188,000
Grand Total			3,294,000	646,000	3,940,000

The breakdown of the construction cost is shown in Clanse11.3 of the Final Report.

CHAPTER 12 WORKSHOP MANAGEMENT PLAN

As far as the rolling stock repair workshop is concerned, essential points of management will be summarized as follows:

(1) To secure the amount of work suitable for the workshop scale, and to keep increase of income.

(2) To save workshop expenditure and to increase the profit.

(3) To secure the quality of repaired rolling stock and not to disturb rolling stock operation because of repair troubles.

(4) To keep the working environment of workshop in good condition for the employee.

To realize the above mentioned four items, several control plans shall be settled as action programs of management plans.

Relations between the four items and several control plans are shown in Table 12-1

Table 12-1 Control plans for management

Points of management	Main control plans for management
(1)	Medium or long term management plan
(2)	Financial management, Material control
(3)	Quality control, Process control, Machinery and equipment control
(4)	Safety control, Sanitary control for worker and working environment

12.1 MEDIUM OR LONG TERM MANAGEMENT PLAN

Several objects of medium or long term management plan would be shown as under;

- Rolling stock maintenance plan based on transport demand forecast
- Improvement of workshop management and operation system
- Improvement of technical situation
- Training of personnel
- Improvement of total quality control in the workshop
- Improvement of safety and sanitary conditions for personnel
- Improvement of financial situation
- Others

12.2. FINANCIAL MANAGEMENT

It is necessary that analysis of cost, profit and operation rate or productivity shall be made to decrease cost and to increase profit.

Relation between cost and profit is shown as under;

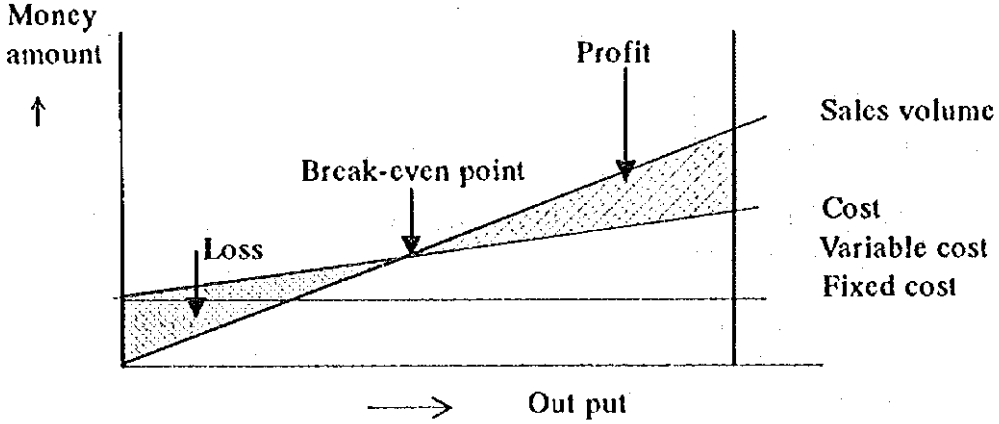


Fig 12.2-1 Cost & Profit

12.3 QUALITY CONTROL

Repaired rolling stock are required to be operated until next repair at least, without disturbing train operation, service interruption of passenger and freight transport, because of repair-related failures and troubles. For this purpose, quality control to work the appropriate quality into rolling stock occupies the important part among workshop management. In Japan, the method of quality control called " Total Quality Control (T.Q.C) " has been widely adopted in the industrial field with effective results.

Applying T.Q.C. to rolling stock maintenance work in the workshop, the whole system of quality control which can guarantee acceptable quality to relevant regulations, standards and specifications of maintenance, namely, quality control organization, function, procedure etc. should be settled, kept and improved. Specific items are shown as under;

(1) Organization

Fix the organization for quality control and clearly show directing lines, duty, responsibility and authority etc.

(2) Function of quality control

To keep mutual close contact, with related sections of technology, repair, inspection and materials, and to promote quality control work effectively, settle the following functions;

1) Function of promoting standardization

2) Function of confirming the exact execution of work in each section

3) Function of executing quickly and appropriately, the examination on troubles

found in and out, and corrective measures for them.

4) Function of executing appropriate management for subcontract and procurement.

(3) Execution of quality control

Settle the following process and sufficiently inform them to related persons.

1) Administration of specifications, standards, drawings etc.

Keeping, revision, distribution and withdrawal shall be suitably conducted.

2) Control of environment

Settle the administration process of specially important environment for quality control, such as maintenance work environment, testing one, inspection one, storage one etc. and always keep them in good conditions.

3) Administration of machinery, facilities and equipment

Settle the administration procedure for authorization, correction and inspection of machinery, facilities and equipment necessary to keep the required quality of rolling stock maintained and always to keep them in good condition.

4) Administration of worker's skill

(a) Nominate dedicated workers to special jobs necessary for quality control.

(b) If necessary, acquisition date and the term of validity of worker's qualification shall be clear and kept.

(c) Carry out necessary pre-planed training for workers, on standards, specifications, work method and quality control etc.

5) Administrations of subcontract and procurement

(a) Settle and execute administration procedure for procurement of materials and subcontract of partial work, necessary to keep the required quality.

(b) Among the above administration procedure, quality confirmation procedure for materials or partial work and administration procedure of subcontractor's quality control.

(c) At receipt of materials procured or subcontracted, acquire, if necessary, information showing their quality characteristics.

6) Inventory control

Inventory control can be mentioned, as a part of material control, as under;

(a) Store materials, parts and repaired apparatus without deterioration of required quality in storing places concerned.

(b) Settle administration procedure of materials and parts for which special storage conditions are necessary to quality control.

(c) Settle storage and distribution procedure for parts and apparatus passed finishing inspection.

7) Repair work process control

(a) Settle and execute the suitable repair work procedure containing quality securing, repair work stabilization, time schedule of repair work and so on.

(b) If necessary, prepare repair work standards etc. for the work in the whole process.

(c) As for the above mentioned (a) and (b), fix necessary items of important works to be confirmed after execution.

(d) Settle administration procedure of specially important working conditions for quality control in repair work process.

(e) Fix disposal and correcting procedure of inferior goods during the whole process.

(4) Test and inspection

Confirm repaired rolling stock to be in accordance with standards, specifications, drawing etc. and always control their quality.

1) Test and inspection shall be carried out in the following cases;

(a) When the materials, parts, processed goods etc. subcontracted or procured, are received. (Acceptance inspection)

(b) When necessary for quality confirmation during the repair work process. (Intermediate inspection)

(c) After repair work finished. (Final inspection)

2) Settlement of inspection standards etc.

Work standards and judgment standards of test and inspection shall be settled in advance.

3) Indication of inspection

Parts and rolling stock which have passed finishing inspections shall be indicated.

4) Management procedure for rejected goods which had not passed inspection shall be settled in advance.

(5) Administration of information on quality

1) The following records and statistics concerning quality control should be utilized inside and outside the workshop for improvement of quality control system.

(a) Records and statistics of control for specially important work condition during the maintenance process.

(b) Results of test and inspection mentioned in (4) 1) and other quality statistics

necessary to quality control.

(c) Records of examination on causes of inspection failure and corrective measures during the maintenance process.

(d) Records and statistics of causes, examination and correctve measures for troubles after shop-out

2) Maintenance records of rolling stock

The following items shall be recorded for rolling stock in charge, and be utilized for operation, maintenance work, preparation of materials and parts.

- Date of manufacture
- Name of assigned depot
- Running kilometer
- Date of maintenance
- Main contents of maintenance work
- Main parts, apparatus exchanged
- Other reference to maintenance

Assumption of future maintenance work, maintenance date by rolling stock, content of maintenance work, preparation of materials and parts in advance, accounting works etc. will be executed effectively and efficiently, by utilizing the records.

12.4 MOTIVATION AND MANAGEMENT CYCLE

The attitude of all employees to work willing in accordance with the guide lines, and steady execution of concrete management plans are essential for the management of workshop.

It will be most important for management to motivate the employees and to move around so-called "management cycle".

12.4.1 Motivation

The results of business with the cooperation of all employees of the enterprise are much greater than those by one excellent leader. Namely, it is essential for leaders to motivate employees to do the work voluntarily in the direction of business improvement.

As the effective methods of motivating employees, "Q.C. circle" and "Suggestion system" are well known and adopted in Japanese industries.

"Q.C. circle" is a group of workers which voluntarily picks up problems mainly relating to Q.C. in the work, and improve or solve them as a group.

Workers, individually or in a group by themselves, suggest solutions to the problems necessary to be improved, and some suggestions will be adopted, if effective. The system is called " Suggestion system". Any problem in the work will do , to be picked up and solved. Actually, most of them are in regard with work method, tool or device for work, cost decrease, safe working etc.. Incentive system for good Q.C. activities and for good suggestions is effective.

12.4.2 Management cycle

" Management or control" means to " Plan" , "Do" ,"See or check" and "Take action or Adjust" in turn. These four items linked in a circle are called "Management cycle". To manage or control is to move around the management cycle. In execution of management plans, the management cycle shall be steady moved around to gain fruitful results.

Incentive system for good Q.C. circle activities and for good suggestion is effective.

CHAPTER 13 WORKSHOP OPERATION PLAN

13.1 OPERATION PLAN OF EL & EC REPAIR

EL & EC introduction to UTJ causes the work of Tashkent Workshop to be changed. Change of the work is its content and its volume. EL & EC repair will become the main work, taking place of the DL repair. The work volume of Tashkent Workshop after the plan's completion is calculated by the number of DL, EL and EC to be repaired. And the workers for the new work volume ((A); EL 55section, EC 40car, (B); EL 104 section, EC 40 car see Chap. 9) are calculated in the following Table 13.1.1

Table 13.1-1 Workers necessary for the repair of EL & EC after the plan's completion

Case	EL	EC	Total
Low case (A)	133	41	174
High case (B)	249	41	290

In the High case, 290 workers are needed, and in the Low case, 174 workers, respectively. In the rounded numbers, approximately 170 to 300 workers for EL & EC shall be supplied. If some contingency is to be considered, i. e., the difference of working circumstances such as of adaptability, of equipment or facilities, of reeducation or retraining, etc. between Uzbekistan and Japan, some coefficient may be multiplied to the numbers. For instance, 1.2 or so. Working out such number of workers is from the decreased work of DL.

Tashkent Workshop has experienced the greater work volume than those of recent years, and there are enough workers convertible to the EL & EC repair. As a conclusion, all the workers for EL & EC will be supplied in the Tashkent Workshop applying reeducated and retrained workers from DL and others.

13.2 MEASURE FOR THE BETTER MANAGEMENT OF TASHKENT WORKSHOP

It seems very advantageous to make a management improvement, catching the timing of introduction of EL & EC to Tashkent Workshop. In this section some measures for the better management are explained by items.

(1) To make the Tashkent Workshop organization tree simpler, by eliminating its two tiered management, and to utilize staff members more freely and widely by making a clear distinction between the staff part and the line (work site; shop) part.

(2) To make effort to decrease the over share to the individual or to the state, etc., as for the housing, public welfare, education ,etc. These are very important and make

good influence to the management.

(3) To reevaluate of manpower of Tashkent Workshop for the better management. The present number of workers is too many for the work volume.

(4) To raise up productivity, execute suitable pre-planned measures among the quantitative methods such as, a study of past experience and improvement of work, introduction of efficient equipment and facilities, continuous reeducation and retraining, encouraging the suggestions for improvement.

(5) To introduce self-supporting basis to the branches of Tashkent Workshop to be conscious of productivity or profitability.

(6) To keep the proper storage of spare parts and goods in the developing phase of the workshop management.

CHAPTER 14 ASSESSMENT AND RECOMMENDATIONS ON THE CONSTRUCTION PROJECT OF ELECTRIC LOCOMOTIVE REPAIR WORKSHOP

14.1 FINANCIAL AND ECONOMIC ANALYSIS

(1) Setting of Evaluation Cases

In this study, two cases are set for comparative evaluation.

Main difference in these two cases lies in two points: First is whether machines and equipment in the workshop that exceed their life period would be replaced(full replacement), or whether replacement would be limited to some of those equipment and machines and the remaining would be kept in use (partial replacement). Second is whether the KP cost would be adjusted or not.

1) Case 1 ; It is assumed that all the equipment and machines that exceed the life period are fully replaced and all the KP cost provided by the UTJ will be used in calculation (see Appendix 14, 1-8,10,11). This case raises the total cost by 1.7 times as much as that for the case of partial replacement.

2) Case 2 ; It is assumed that the equipment and machines that exceed the life period is partially replaced and the KP cost in Uzbekistan provided by the UTJ is adjusted to be 80% of the entrusted KP cost in foreign country (see Appendix 14, 1-9, 10, 11).

(2) Economic Cost

Economic cost is calculated by excluding taxes from the prices at market. Cost at the market prices is composed of the following items:

1) Construction and facility cost
2) Consulting service fee is set at 10% of the construction and facilities cost.
3) Contingency is set at 5% of the construction, facilities and consulting service fee.
4) Maintenance cost for the new facility is set at 5% of procurement cost.

(3) Economic Benefit

This project generates various kinds of economic benefits, and of which two are incorporated in this evaluation. All economic benefits are defined to be a difference

in costs between "with" project and "without" project.

1) Saving in KP cost	This results in a saving in high overhauls cost in foreign country, and a saving in scarce foreign currency reserves.
2) Reduced number of EL and EC ;	Additional 12Els and 4Ecs are necessary for KP in foreign country, because it takes 44 days for transportation of EL and EC for KP in foreign country. In "with" project, additional ELs and ECs are unnecessary.

For non-qualitative benefit, the availability increase of EL and EC due to the reliability increase of them by this Project is expected.

(4) Assumptions for Economic and Financial Analysis

Assumptions presented below are introduced. As for the opportunity cost of capital is not clear because of turmoil and transformation process to the market economy. So the 12 %, which is adopted for the countries that have many high return projects.

1) Economic Analysis

(a) Project life	;	It is set at 30 years by taking account of the life of equipment and machinery. It falls on 1997-2026.
(b) Opportunity cost	;	equivalent to 12%
(c) Currency expressed	;	US $ Exchange rate; US$1=120 Yen=100 Sum,

2) Financial Analysis

In addition to the assumptions to economic analysis above, the following will be incorporated.

(a) Tax rates	;	Income tax = 37%

(5) Evaluation Indicators

Case		EIRR	FIRR
Case 1	Base Case	10.3%	9.7%
	Cost=+10%, Benefit=-10%	5.6%	4.9%
Case 2	Base Case	17.1%	15.0%
	Cost =+10%, Benefi=-10%	7.1%	5.5%

(6) Conclusions

Economic evaluation shows that Case 2 of this project (partial replacement of equipment) has an EIRR of 17.1% and is feasible. And an execution of Case 2 is recommended. However, sensitivity analysis with cost increase by 10% and benefit decrease by 10% indicates 7.1% of EIRR, lower figure than the opportunity cost of capital (=12%), and suggests that Sufficient attentions should be paid to economic and price conditions when the project is implemented. It is judged that Case I (total replacement of the equipment) can not be feasible since EIRR is at the level of 10.3%, lower than the opportunity cost of capital.

Financial analysis shows the same results as the economic analysis. Case 2 has a sufficiently high figure of FLRR of 15.0% to guarantee the profitability of the project, and the implementation of the project (Case 2) is suggested. Sensitivity analysis (cost increase by 10% and benefit decrease by 10%) also indicates that FIRR is lowered to 5.5%, and is significantly affected by changes in cost and benefits. It is suggested that attentions should be paid when the project is implemented.

14.2 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Relating to the construction of electric locomotive repair workshop in Tashkent Workshop, there will not be a direct influence on other social environmental factors, such as resettlement, split of communities, cultural property and water right and common land rights, and on other natural environmental factors, such as fauna and flora, topography, geology, soil erosion, meteorology, and landscape.

In addition to the above, even though the following several factors are taken into consideration, the workshop construction in Tashkent Workshop will not induce a significant deterioration of environmental condition.

(1) Construction Phase

- (Air quality) dust will be generated by demolition of existing structure, especially on windy days.

- (Wastewater) raw sewage to be produced during the construction of this project will be sent into the municipal sewage system.

- (Waste) changing machines and equipment and demolition of building will generate waste. Recyclable materials such as metal, glass, and so on should be separated from waste in order to reduce the quantity of solid wastes.

- (Noise) noise will be generated by the construction activities, mainly from construction equipment. It is necessary to explain it to neighbors.

- (Traffic) the traffic will occur between inside and outside of the Tashkent

Workshop in order to carry construction heavy equipment, materials, wastes and so on. It is necessary to arrange the traffic control personnel for the safety of the passenger.

(2) Operation and Maintenance Phase

- (Air quality) the emission of air pollutants will not be changed after the construction of new facilities.

- (Water consumption) water consumption won't surpass this maximum permissible consumption. So there will not be problems relating to land subsidence and hydrological situation.

- (Wastewater) after operating the new wastewater treatment facility, the quality of wastewater will be improved and the quantity of wastewater will be reduced. This facility is necessary for the Workshop to function well environmentally.

- (Waste) the quality and the quantity of solid waste will not be changed before and after this project. The Tashkent Workshop separates and recycles many materials such as metals, glass, oil products and so on, but it is necessary to further reduce the quantity of wastes at present.

14.3 EXECUTION PLAN OF THE PROJECT

Tentative process of executing the project after submitting Final Report will be assumed as shown in Fig 11.2.4-1.

14.4 FUND PLAN

According to UTJ's funding plan relating to the project, about 125million US$ including project cost of EL repair workshop construction plan, rolling stock and spare parts procurement plan, etc. is estimated in total.

Construction cost for this Project estimated by JICA team is 3940 million yen or 33 million US$ (exchange rate :1 US$= 120 yen) in total, and 3295 million yen or 27 million US$ (exchange rate = the same) partially in foreign currency is within UTJ's

estimation of 25～30 million US$. (refer to Clause 4.1.5-(2))

14.5 OVERALL EVALUATION AND RECOMMENDATIONS

(1) It is desirable that construction of the electric locomotive repair workshop proceed in accordance with the contents of the Final Report.

1) Financial and economic analysis reveal that the project will be feasible.

2) Significant environmental deterioration will not be caused by construction of the electric locomotive repair workshop in Tashkent Workshop.

3) The construction cost estimated by the JICA team coincides approximately with the funds planned by UTJ.
There will be no special problem relating to the funding plan.

(1) It is necessary to procure sufficient spare parts for undertaking KP-1 and KP-2 of rolling stock, in order that daily operation of the workshop may proceed smoothly.

(2) It is recommended that the following items are examined for the improvement of UTJ or workshop management and operation.

1) Transportation.

(a) For the improvement of passenger service.

a) Public announcement or advertising of train operation time table.

b) Train speed-up.

c) Improvement of track for train speed-up and good riding quality

2) Rolling stock maintenance work

(a) Improvement of maintenance work for electric rotating machine, etc.

(b) Improvement of cleaning of rolling stock and parts.

(c) Keeping work sites orderly and clean.

(d) Application of neutral detergent for cleaning.

(e) Increase of electric power supply capacity with the electricity authority.

3) Replacement of life-expired machinery.

4) Environmental facilities.

(a) Early completion of waste water treatment facilities in Tashkent Workshop.

(b) Reduction of dust emission from the present operating facilities in Tashkent Workshop.

(c) Establishment of minimization project on waste water, wastes and air pollution.

5) Management and operation.

(a) As UTJ heads towards becoming a more commercially-driven business, operating in a market economy, there will be an increasing need to review the entire basis of its internal accounting system in order to ensure that costs and revenues are properly allocated to the appropriate business activities at the lowest practicable level.

(b) UTJ must look very closely at which of its current activities it wishes to retain and which it would prefer to divest. Regardless of the nature of any privatization strategy (if indeed any), the company may well wish to review the scope of its future involvement even in activities such as track maintenance or rolling stock maintenance, particularly if investment funds are liable to be scarce.

(c) Steps should be taken, with the help of the new ticketing system, to establish a comprehensive data-bank of origin and destination information (together with other market data such as journey purpose, age, socio-economic grouping etc.), in order that a much more detailed picture of passenger travel demand can be painted.

(d) The likely ending of cross-subsidies from the freight to the passenger business will pose particular challenges for management. It is recommended that a review of existing high-cost strategies in the passenger business is urgently undertaken-particularly, for example, a review of the policy of running many passenger trains overnight which is extremely expensive in both capital and operating cost.

(e) The emerging scale and costs of this project, as it develops, need to be monitored closely in conjunction with the development of parallel projects such as electrification and locomotive procurement.

(f) Increase of daily car-kilometer for effective rolling stock operation management.

(g) Improvement of productivity in relation to the number of workers engaged in repair work and its volume.

(h) To make the Tashkent Workshop organization tree simpler, by eliminating its two-tier management structure and to utilize staff members more flexibly and widely by making a clear distinction between the staff part and the line (work site; shop) part

(i) As the effective method of motivating employees, adoption of "Q.C. circle"

and "Suggestion System" is recommended. And incentive system for good Q.C. circle activities and for good suggestions is effective.

(j) Steady moving around of management cycle, such as plan, do, monitor and adjust.

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