PART III FEASIBILITY STUDY

CHAPTER 10 IMPROVEMENT OF DOSTYK TERMINAL

10.1 General

10.1.1 Necessity for the Project

Regular transport of international cargos between Dostyk (formerly Druzhba) and Alashankou (China) started in 1992. This transport corridor was named the 'China Land Bridge' which was widely recognized as the major transport corridor between East Asia and Central Asia. Since that time, international cargos through Dostyk have been increasing year by year. However, while minor improvement works have been made since the opening, no major works have been undertaken at all.

Moreover, container cargos have been drastically increasing recently. As a result, cargo congestion and delay of container cargos occurs at not only Dostyk Terminal but also Alashankou due to shortage of facilities for containers at Dostyk Station. These issues may have badly affected the development of the China Land Bridge.

The proposed Dostyk Terminal Project has the following needs:

1) Dostyk Station functions as a gateway for international railway cargos from East Asia (Japan, Korea, and China). This terminal is also where changing gauge from narrow gauge (in China) to broad gauge (in the CIS countries including Kazakhstan) takes place. The main operations performed at Dostyk Terminal include breaking up and making up trains, and loading and unloading from wagons on narrow gauge to wagons on broad gauge. The improvement of these facilities will be on a large scale.
2) This station functions as a transshipment point for import and transit cargos. Recently, import and transit container cargos have dramatically increased. The share of container cargos to total cargos rose to 40% in 2006 compared to 26% in 2005. These issues generate congestion and delay of container cargos at Dostyk Station due to the shortage of facilities for handling container cargos. It is necessary to expand the capacities of such facilities.
3) In recent years, there have been some changes in train operations, such as an increase of block trains. But there are not enough facilities and container trains for breaking-up and making-up the block trains. It is necessary to improve such facilities.
4) The China Land Bridge through Dostyk Station between East Asia and Central Asia has been developed. This Land Bridge has further potential to expand from East Asia to Central Asia/Iran, the Caucasus/Turkey and Russia/Europe. This may be achieved through the development of Dostyk Station.

10.1.2 Purpose of the Study

The purpose of the present Feasibility Study is to comprehensively evaluate the feasibility of improving Dostyk Station based on the following aspects:

a) Formulating optimum improvement measures at Dostyk Station to solve present bottlenecks of the terminal and meet future freight traffic demand,

b) Conducting preliminary design and estimation of the project cost,

c) Economic and financial analysis, and

d) Formulating an implementation plan.

10.1.3 Study Approach

Figure 10.1-1 illustrates the procedural flow of logistics terminal development at Dostyk Station consisting of the following steps.

1) Present Conditions at Dostyk Terminal and Identification of Issues

Present conditions for freight traffic, operation and facilities in Dostyk are analyzed. Based on the analysis, problems and issues are identified.

2) Freight Traffic Demand Forecast at Dostyk Terminal

Based on present conditions for freight traffic at Dostyk Terminal and the socio-economic framework in Kazakhstan and neighboring countries, freight traffic demand at Dostyk Terminal is forecast.

3) Formulating a Concept Plan for the Dostyk Logistics Terminal Development

To address present problems and issues and projected future traffic demand, a concept plan for the Dostyk Terminal development will be formulated taking into account the following factors:

a) Dostyk terminal improvement plan approved by the Government No. 676

b) Special economic zone and Khorgos logistics terminal construction plan

c) Construction plan for a new railway line between Khorgos and Saryozek

4) Environmental and social considerations

An environmental and social consideration study on Dosytk Terminal is carried out.

5) Preliminary design of Dostyk Terminal

A preliminary design of Dostyk Terminal is created and construction costs as well as maintenance and operation costs are estimated on the basis of quantity estimates and unit cost estimates[MSOffice1].

6) Economic and financial evaluation

The improvement of Dostyk Terminal is analyzed economically and financially. Based on the analysis made, economic feasibility and financial viability are evaluated.

7) Formulation of implementation program

Lastly, an implementation program is formulated and an investment program is presented.

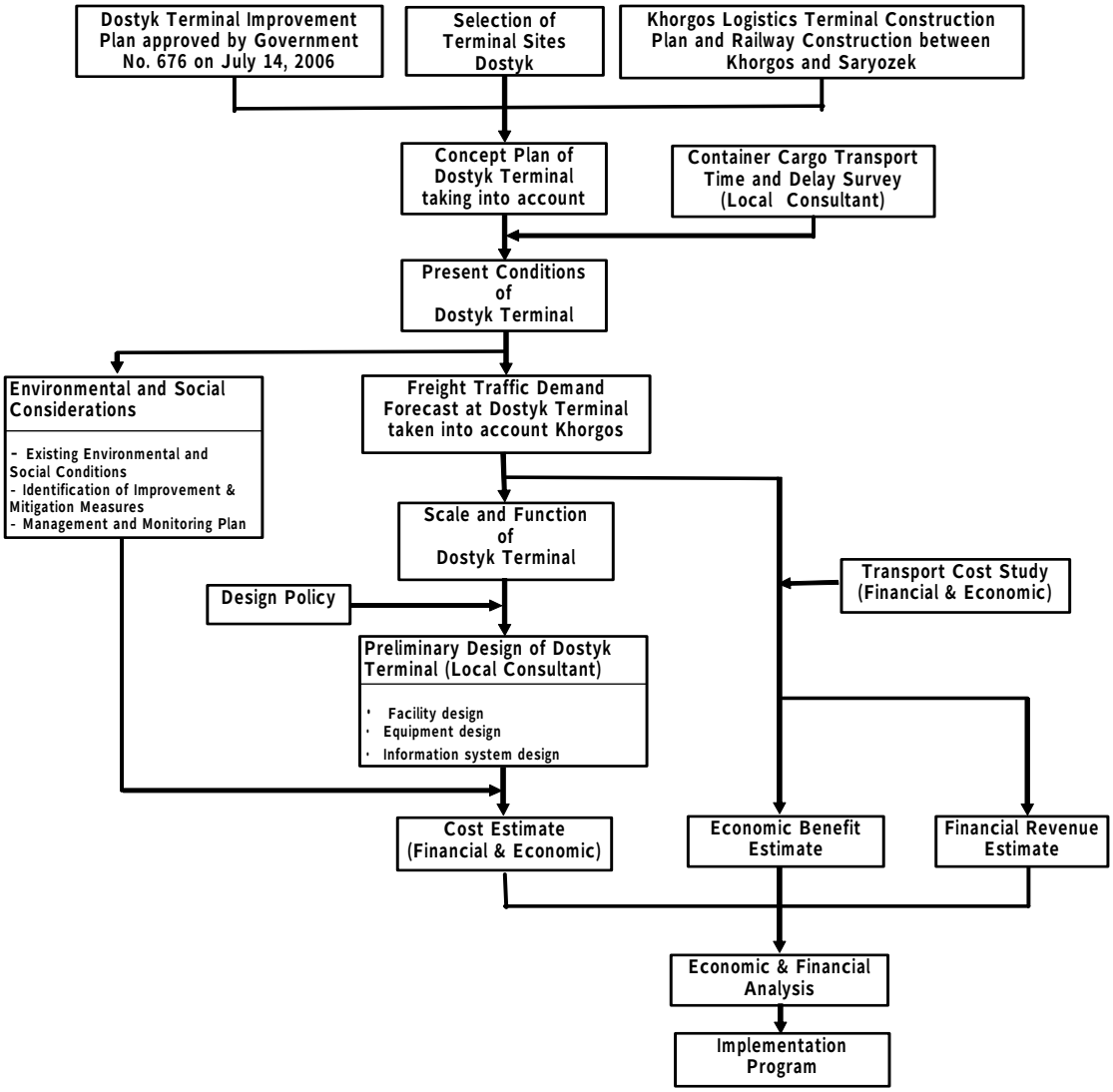


Figure 10.1-1 Flow Diagram for the Dostyk Terminal Feasibility Study

10.2 Present Conditions at Dostyk Station

10.2.1 Natural Conditions

(1) Geographical Condition

Dostyk Station is located in Almatinskaya Oblast, the southern part of Kazakhstan, and about 10 km from the border to China. The topographical location of Dostyk Station is the plain area between high mountain ranges on the north and south sides. Soil condition is a chestnut chernozem of high mountains with no salt. Geologically, there has been no earthquake disaster in the last 30 years.

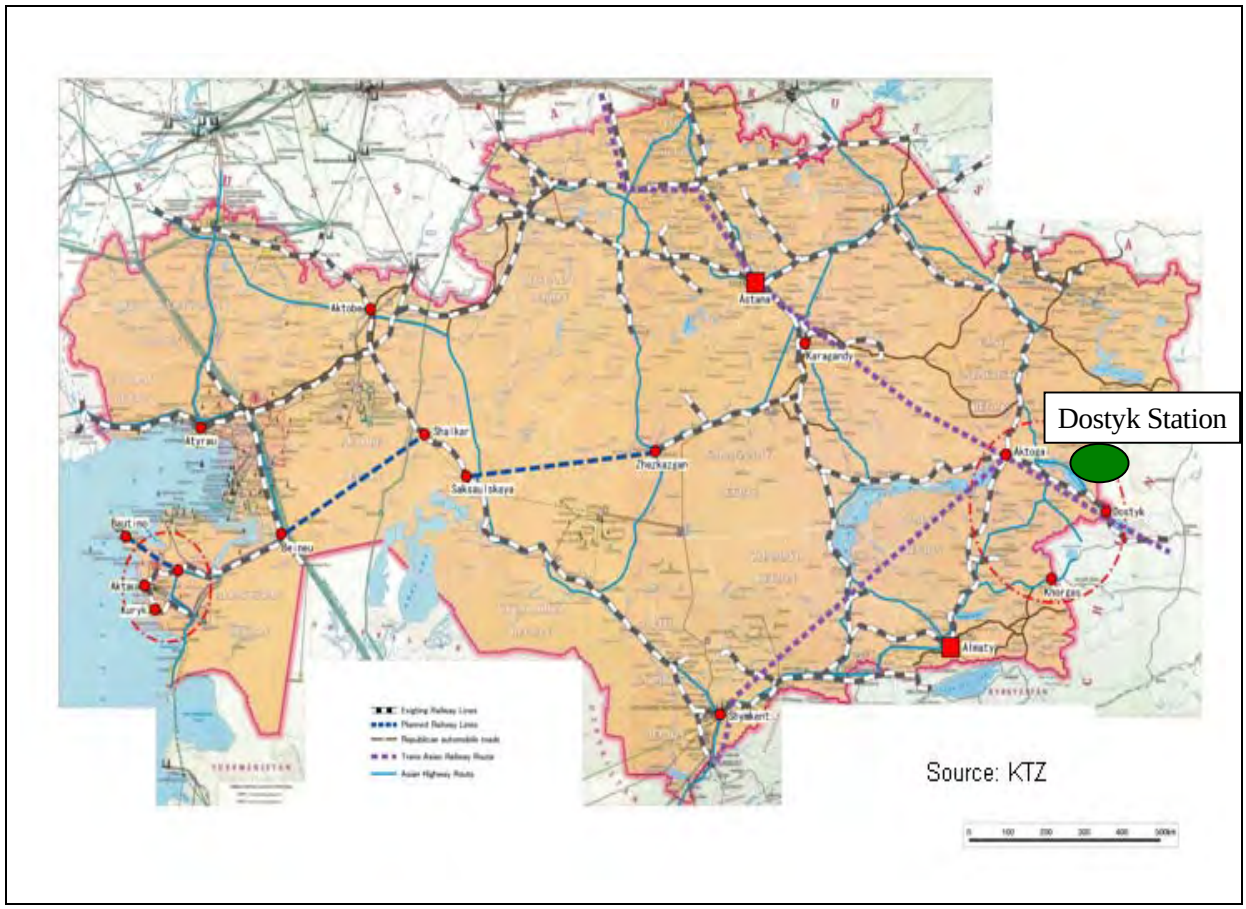


Figure 10.2-1 Location of Dostyk Station

(2) Climate

This region belongs to dry steppe, which is characterized by the large area of grassland and sandy regions. The climate is continental, with extremes in temperature, and mostly arid with little rainfall. The annual mean temperature is about 20 degrees centigrade in summer and minus 10 degrees in winter while the maximum in summer is about 45 degrees and the minimum in winter is about minus 50 degrees.

(3) Precipitation

Annual precipitation at the project site is in the range of 300-400 mm per year, which can be considered an average and is comparatively less than the average for the southern part of Kazakhstan of over 800 mm per year.

(4) Wind

Because of the topographical characteristics, there are windy days and nights throughout the year in the plain area between the high mountain ranges on the north and south sides. The superior wind direction is from the southeast at more than 20 km/h on average, especially in winter. Therefore, outdoor work is difficult and handling time for equipment is limited in winter.

10.2.2 Facilities and Equipment at Dostyk Terminal

Main operations performed at Dostyk Station include breaking-up and making-up of trains, loading and

unloading of freight from narrow gauge to broad gauge wagons. The trains are handled and new trains are made up in accordance with a settled plan. During these operations, customs clearance also is given. For dealing with these operations, Dostyk Station has 5 types of yards and 7 types of transshipment points. Figure 10.2-2 shows the layout of facilities at Dostyk Terminal.

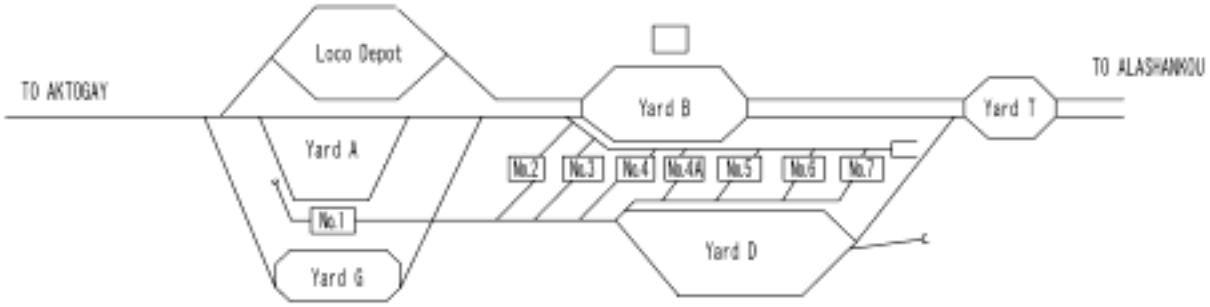


Figure 10.2-2 Layout of Facilities at Dostyk Terminal

(1) Yards

The functions of each yard are described as follows.

1) "T" Customs Yard

All passenger and freight trains stop on the tracks at "T" yard for immigration and customs check when arriving at Dostyk Station from China or departing from Dostyk to China. "T" Yard consists of 4 tracks: 2 tracks of 1520 mm gauge and 2 tracks of 1435 mm gauge. The availability of 2 tracks of each gauge enables simultaneous customs inspection of trains dispatched to China and arriving from China. An X-ray inspection system is installed between "T" Yard and the next yards.

(“T” Yard)	(Truck queue to China in front of “T” Yard)
	
(X-ray inspection system)	(X-ray inspection system)

2) Receiving - Departure “A” yard, 1520 mm Gauge

“A” yard is designed for receiving and dispatching export freight to China, dispatching import freight and returning empty wagons to Kazakhstan. Sorting is also one of the operations carried out here. “A” yard consists of a main track and 13 receiving-departure-sorting tracks. The capacity of the receiving-departure tracks is 76 wagons. The horizontal profile of the yard is presented by a straight line while the vertical profile is on a slope

3) Shunting Yard G

“G” yard operates shunting procedures. Shunting for train break-up is carried out by a shunting locomotive working at the draw-out track. A checklist is made up for every break-up of rolling stock. Wagons are shunted with respect to the purpose of the making-up plan or by the serial number of the accumulating tracks.

	
(“G” Yard)	(Operating Center at “G” Yard)

4) Receiving—Departure Passenger "B" Yard

"B" yard consists of 5 tracks. One joint gauge track, 1435 gauge track with a capacity of 16 wagons, and 1520 gauge with a capacity of 23 wagons, are used for receiving and dispatching passengers. The other two tracks are the crossover and running tracks. In addition to operations with passing trains, the "B" yard tracks are also used for receiving-departure freight trains and shunting movements to the Train Transfer Point.

5) Receiving-Departure "D" Yard, 1435 mm Gauge

Five receiving-departure tracks of "D yard" are used for (1) receiving import cargo from China, (2) dispatching export cargo along with the change of wheel sets and (3) returning empty wagons to China. There are also 4 sorting tracks.

("D" Yard)

("D" Yard)

(2) Train Transfer Point (TTP)

Hand-over of cargos and wagons as well as reloading and wheel set changes are carried out at Dostyk Terminal, the border station. At present Alashankou Station has no Train Transfer Point and therefore, the Train Transfer Point at Dostyk Station is engaged in transferring passenger and freight wagons from 1520 mm gauge to 1435 mm gauge and vice versa by changing wheel sets. In addition, it performs maintenance of wagons and trucks on both gauges and has the function of storage of wagons and trucks. The functions of the Train Transfer Point are as follows.

1) Train Transfer Point No. 1

TTP No. 1 operates to reload scrap metal and packed goods from wagon to wagon, load-unload motor-cars and other machinery on open rolling stock and unload construction materials in bulk. It has two tracks of 1435 mm and 1520 mm gauges. The height of the platform corresponds to the level of freight wagon floors. The railway platform has capacity for 32 wagons for both Kazakhstan and China with 3 reloading cranes (two of them with 32 t of load capacity and one with 20 t).

2) Train Transfer Point No. 2

TTP No. 2 is a hangar type and cross entrance of wide gauge tracks and narrow gauge track. This point is

for reloading Chinese covered wagons, 1435 mm gauge covered wagons and the following 1520 mm gauge cargos: piece-goods and perishable and valuable goods requiring cover from precipitation (tea, tobacco and so on). Reloading is carried out manually and mechanically. The mechanical method is used for reloading of cargos packed and stowed on pallets especially for truck loaders and also of heavy packages. Truck loaders (8 electric and 1 diesel) with weight-carrying capacity up to 1500 kg are used. When a cargo has many packages, reloading and sorting are carried out manually.

3) Train Transfer Point No. 3

TTP No. 3 is a covered hangar with internal cross entrance of 1520 mm gauge and 1435 mm gauge tracks. Useful length of the freight loading point provides arrangement of 14 wagons of Kazakhstan and China for loading and unloading. It is used for freight storing and equipped with shelves and pallets. This point has 8 fork-lifts with 1.5-1.8 tonnage capacity. Direct reloading from wagon to wagon using the fork-lifts (for packed freight) and loading-unloading machines (for unpacked cargos) is a common procedure here.

(Train Transfer Point No. 3)

(Fork-lift in TTP No. 3)

4) Train Transfer Point No. 4

TTR No. 4 operates for container loading. It is an unheated covered hangar with cross entrance of 1520 mm gauge and 1435 mm gauge tracks. The reloading point has two electric traveling cranes with a capacity of 30.5 tons and a container palletizer with 41-ton capacity, which can keep containers in two layers. This point provides space for 25 wagons of Kazakhstan and China.

	
(Train Transfer Point No. 4)	(Electric Traveling Cranes at TTP No. 4)

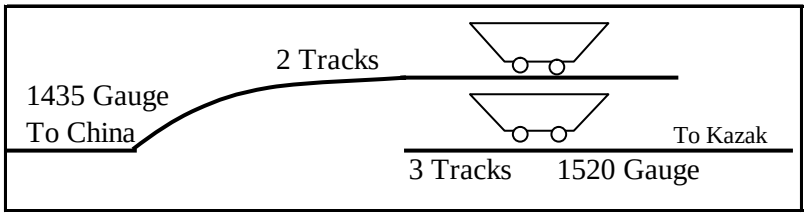
5) Train Transfer Point No. 4A

TTR No. 4A (outdoors) operates for transfer of large tonnage containers using a container palletizer with 41-ton capacity, pneumatic cranes and truck cranes for piece cargos. Point No. 4A has two tracks with cross entrance receiving 25 wagons of Kazakhstan and China. There are also a technical building with garage, a storehouse for combustible lubricant materials and amenity rooms.

	
(Train Transfer Point No. 4A)	(Train Transfer Point No. 4A)

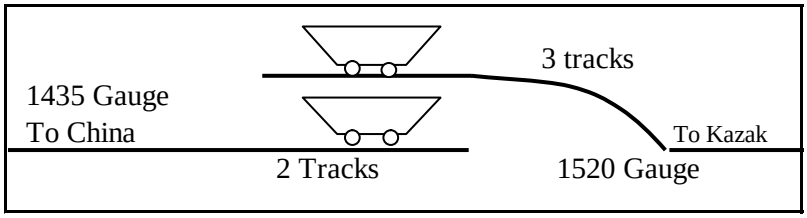
6) Train Transfer Point No. 5

TTP No. 5 is for transfer of bulk freight. The main freight is coke and oil-coke. It is equipped with a two-level overpass and a cross entrance of two 1435 mm gauge tracks and three 1520 mm gauge tracks. This point has technical facilities such as a vibration loader and a power shovel for transfer work. Operation is carried out for 4 wagons on each track, in total 8 wagons on two 1435 mm gauge tracks and 4 wagons on each track, in total 12 wagonson three 1520 mm gauge tracks.



7) Train Transfer Point No. 6

TTP No. 6 operates for grain freight reloading. It is equipped with a two-level overpass and a cross entrance of narrow-gauge tracks and wide-gauge tracks. This point can take 6 Chinese wagons on two tracks and 9 Kazakhstan wagons on three tracks.



(Train Transfer Point No. 6, upper level)

(Train Transfer Point No. 6, lower level)

(Loading operation at TTP No. 6)

(Conveyor belt at TTP No. 6)

8) Train Transfer Point No. 7

TTP No. 7 operates for reloading packed-piece, heavy weight and long length cargos and wheel machinery from wagon to wagon. This point also handles “Local Freight”, which is from China by truck to Kazakhstan railway. It has two tracks of 1435 mm and 1520 mm gauges. The railway platform has capacity for 24 wagons for both Kazakhstan and China with 2 reloading cranes (with 50- and 30-ton load capacities respectively).

(Train Transfer Point No. 7)

(Train Transfer Point No. 7)

9) New Train Transfer Point

The new Train Transfer Point close to “G” Yard is being developed and will open by the end of 2007. This point is a hangar and handles covered wagons. It is planned as a comprehensive Transfer Point with facilities for quarantine and customs clearance operation.

(New Train Transfer Point)

(New Train Transfer Point)

	
(New Train Transfer Point)	(New Train Transfer Point)

(3) Bogie Interchange Yard

The Bogie interchange point, where bogies from narrow gauge to wide gauge and vice versa are interchanged, is located near "A" Yard. This point has two sets of tracks that can take 15 wagons in one operation.

(Bogey Interchange Point)

(Bogey Interchange Point)

(Bogey Interchange Point)

(Bogey Interchange Point)

Table 10.2-1 Transshipment Point Facilities at Dostyk Station

TR No.	Description of Function and Facility
TR No. 1 (open yard)	– Unloading, loading, transshipment of packed-piece and bulk cargos and wheel machinery from 1435 mm-gauge cars to 1520 mm-gauge cars and vice versa (with unloading of the cargo to the loading platform) • Total area is 3840 m^2. • Length of the loading platform is 480 meters and width is 8 meters. • Line No. 15 is joined to the 1520 mm gauge. • Line No. 114 is joined to the 1435 mm gauge. • Hours of operation: 12 hours (from 9:00 till 21:00) • Lessee: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 30 cars; 1435 mm gauge – 30 cars
TR No. 2 (hangar)	– Transshipment of packed-piece and perishable goods from 1435 mm-gauge covered wagons to 1520 mm-gauge wagons and vice versa • Total area is 3633 m^2. • Line No. 303 is joined to the 1520 mm gauge. • Line No. 152 is joined to the 1435 mm gauge. • Hours of operation: twenty-four hours a day • Lessee: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 13 cars; 1435 mm gauge – 13 cars
TR No. 3 (hangar)	–Transshipment of packed-piece and perishable goods from 1435 mm-gauge wagons to 1520 mm-gauge wagons • Total area is 5700 m^2. • Line No. 305 is joined to the 1520 mm gauge. • Line No. 154 is joined to the 1435 mm gauge. • Hours of operation: twenty-four hours a day • Lessee: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 14 cars; 1435 mm gauge – 13 cars

TR No. 4 (hangar)	– Unloading, loading and transshipment of large-capacity containers from 1435 mm-gauge wagons to 1520 mm-gauge wagons and vice versa with unloading of the wagons to the loading platform • Total area is 9849.3 m^2. • Line No. 306 is joined to the 1520 mm gauge. • Line No. 155 is joined to the 1435 mm gauge. • Hours of operation: twenty-four hours a day • Lessee: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 25 cars; 1435 mm gauge – 25 cars
TR No. 4A (open yard)	– Unloading, loading and transshipment of containers, packed-piece, bulk, heavy-weight, wheel machinery from 1435 mm-gauge wagons to 1520 mm-gauge wagons and vice versa according to a plan (with unloading of the cargo at the loading platform). • Total area is 11000 m^2. • Line No. 307 is joined to the 1520 mm gauge. • Line No. 156 is joined to the 1435 mm gauge. • Hours of operation: twenty-four hours a day • Lessee: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 25 cars; 1435 mm gauge – 25 cars
TR No. 5 (hangar)	– Transshipment of bulk cargos from 1435 mm-gauge wagons to 1520 mm-gauge wagons, two-level platform. • Total area is 1715 m^2. • Lines No. 309, 310, 311 are joined to the 1520 mm gauge. • Lines No. 157, 158 are joined to the 1435 mm gauge. • Bulk Cargo Tank • Hours of operation: twenty-four hours a day • Lessee: JSC KedenTransService • Number of cars supplied: gauge 1520 mm gauge – 4 cars; gauge 1435 mm gauge – 4 cars
TR No. 6 (hangar)	– Transshipment of bulk cargos from 1520 mm-gauge wagons to 1435 mm-gauge wagons. • Total area is 1412 m^2. • Lines No. 161, 162 are joined to the 1520 mm gauge. • Lines No. 316, 317, 318 are joined to the 1435 mm gauge. • Tanks • Hours of operation: twenty-four hours a day • Lessee: LLP Universal Services • Number of cars supplied: 1520 mm gauge – 8 cars; 1435 mm gauge – 12 cars

TR No. 7	– Transshipment of packed-piece, heavy-weight and long-length cargos, wheel machinery, average and large-capacity containers from 1435 mm-gauge wagons to 1520 mm-gauge wagons and vice versa • Line No. 501 is joined to the 1520 mm gauge. • Line No. 401 is joined to the 1435 mm gauge. • Hours of operation: twenty-four hours a day • Owner of the line: JSC KedenTransService • Number of cars supplied: 1520 mm gauge – 12 cars; 1435 mm gauge – 12 cars

Source: KTZ Dostyk Station

10.2.3 Operation System in Dostyk Terminal

The main operations performed at Dostyk Station include breaking-up and making-up of trains, loading and unloading of freight from narrow-gauge to wide-gauge wagons; trains are handled and new trains are made up in accordance with a plan. During these operations, customs clearance is also carried out.

(1) Basic Content of Handling

The basic operation procedure at Dostyk Terminal is as follows.

- Receive trains from China on receiving track
- Break-up and wait for reloading
- Inspection and customs clearance
- Reload onto wide-gauge wagons
- Idling due to departure of switch wagons
- Joining of wagon set
- Dispatch

(2) Operation Center

There is a train operation center where trains and control command of wagons and locomotives at Dostyk terminal are operated.

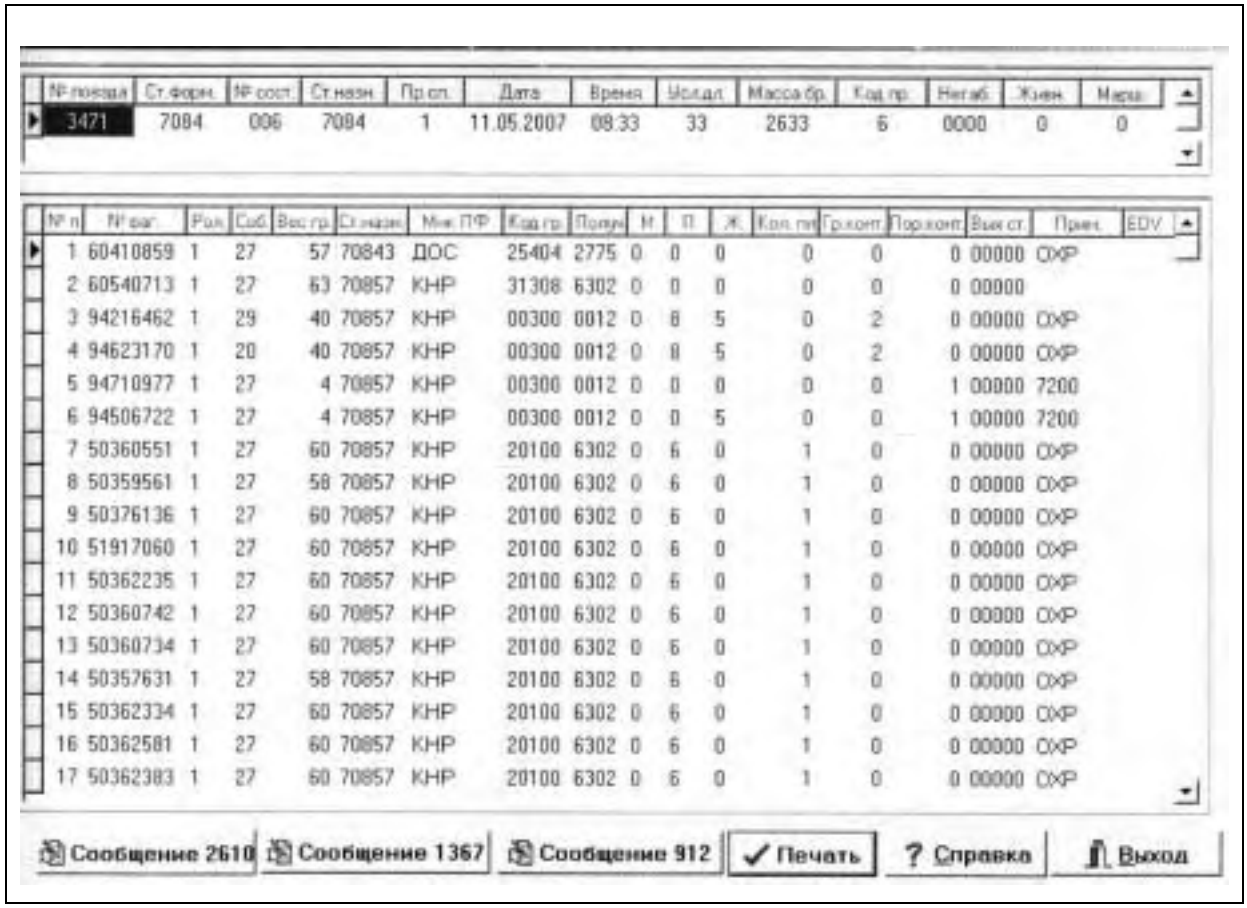



Train and wagon information is managed by use of the computer system in Table 10.2-2.

Table 10.2-2 Computational Items at Operation Center

Train Information	Cargo Information
• Train Number • Station of Train Formation • Destination Station • Date and Time • Reference Length • Gross Weight • Locomotive Number • Oversized Cargo Information • Live Cargo Information • Route	• Cargo Number • Cargo Owner • Cargo Weight • Cargo Destination • Location of Cargo Formation • Consignee • Route • Fleet Code • Live Cargo information • Number of Seals • Loaded / Empty Container Code • Exit Station • Bill

Source: JICA Study Team



Source: JICA Study Team

Figure 10.2-3 Computer Display Capture Image at Operation Center

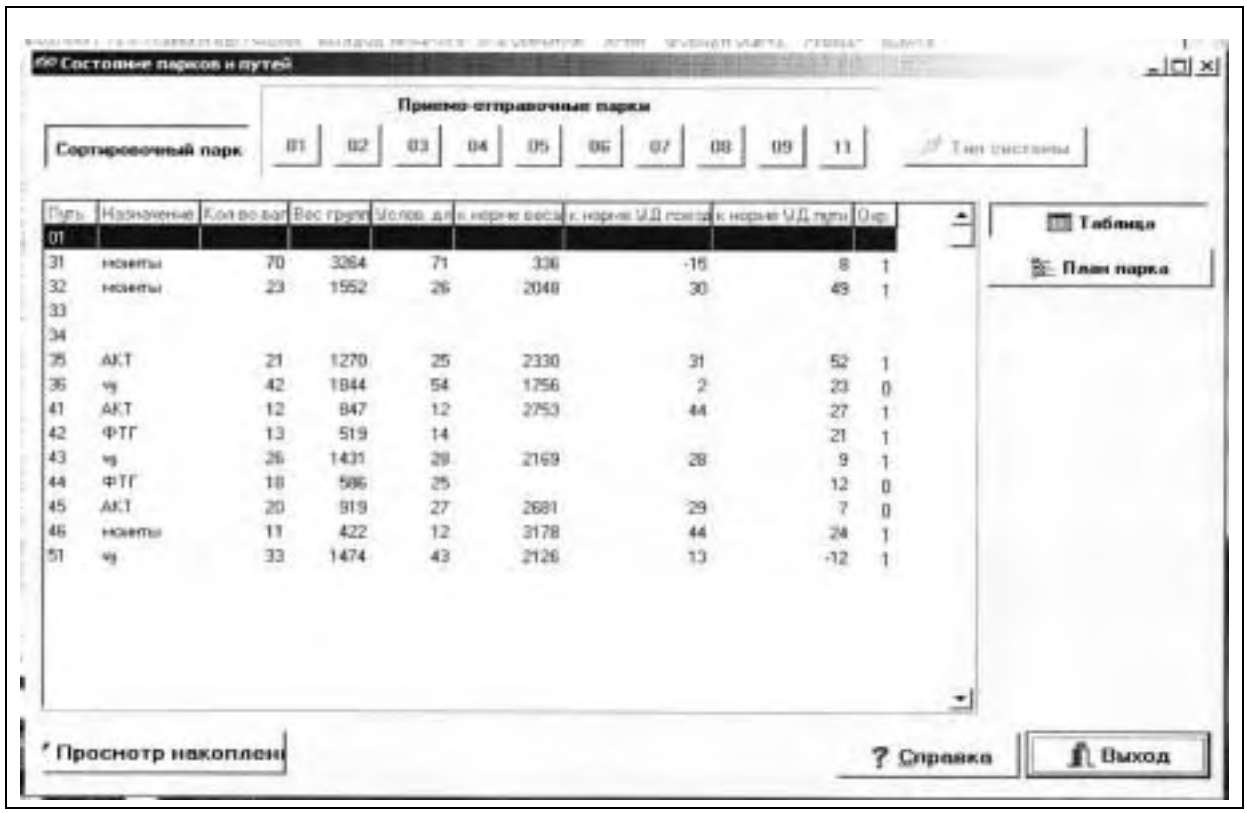
(3) Shunting Control Center

The shunting operation is handled at the shunting control center near "G" Yard by use of the computer system in Table 10.2-3.

Table 10.2-3 Computational Items at Shunting Center

• Track Number • Destination • Number of Cars • Weight of Groups • Conventional Length (Reference)	• Against the weight rate • Against conventional length of the train • Against conventional length of track • Guarding

Source: JICA Study Team



Source: JICA Study Team

Figure 10.2-4 Computer Display Capture Image in the Shunting Center

The operator of the yard office registers information by track twice a day, at 9:00 a.m. and 21:00, by recording wagon numbers in the Register. On the basis of data about wagon availability at tracks and information on train arrival, the shunting dispatcher decides the queue for arriving train break-ups, giving priority to those with groups of wagons and to those with urgent freight wagons.

(4) Customs clearance procedure

The pictures shown below are of the customs clearance office at "B" yard. Translation of documents from

English or Chinese to Russian by staff and data input procedures are carried out here.

Customs clearance is processed as follows.

- Information on incoming train
- Wagons arrive at the yard
- Immigration and customs preparation
- Immigration and customs check
- Train received at the yard
- Rolling stock attachment
- Locomotive splitting
- Commercial and technical check
- Rolling stock check
- Hand-over cargo to security
- Submission of documents to customs office
- Issue of integrated certificate
- Document translation
- Document check by quarantine, commercial office and customs
- Document hand-over to cash counter
- Issue of Wagon Sheet

(5) Train Transfer Operation

The basic train transfer operation is carried out by the following procedure.

- Information on not only incoming loaded wagons requiring transfer from 1520 mm gauge to 1435 mm gauge but also empty wagons for transfer from 1435 mm gauge to 1520 mm gauge;
- Wagon selection and supply from the station to the Train Transfer Point (TTP);
- Wagon checking by numbering;
- Wheel set truck selection;
- Arrangement of wagons as per location

- Wheel set truck change
- Wagon joining, testing of automatic brakes and removal of wagons from transfer track;
- Hauling of freight wagons subject to transfer by the station locomotive. (TTP operator selects wheel sets according to the list of wagons. TTP locomotive transposes freight wagons to the respective locations.)

10.3 Freight Traffic Conditions at Dostyk Terminal

10.3.1 Freight Traffic Survey

(1) Objective of the Survey

The objectives of the freight traffic survey are to analyze the characteristics of cargo movement and identify the problems and bottlenecks of train operation at Dostyk Terminal. Feasibility studies for the Dostyk and Aktau terminals are carried out using the results of this survey. The components of the freight traffic survey are:

- CARGO MOVEMENT SURVEY; carry out a cargo movement survey at 2 survey points on the eastern border in winter and spring and 1 point on the western border in winter
- SCHEDULE and DELAY SURVEY; trace container movement and register time at checkpoints and reasons for cargo delays from China to Kazakhstan at Dostyk station, and
- OPERATION TIME SURVEY; register handling time at Dostyk station during a one-week period.

(2) Location of the Survey

The survey points are located at the following 3 places:

A: Eastern border points: (a.1) Dostyk, (a.2) Khorgos

B: Western border point: (b) Aktau Port

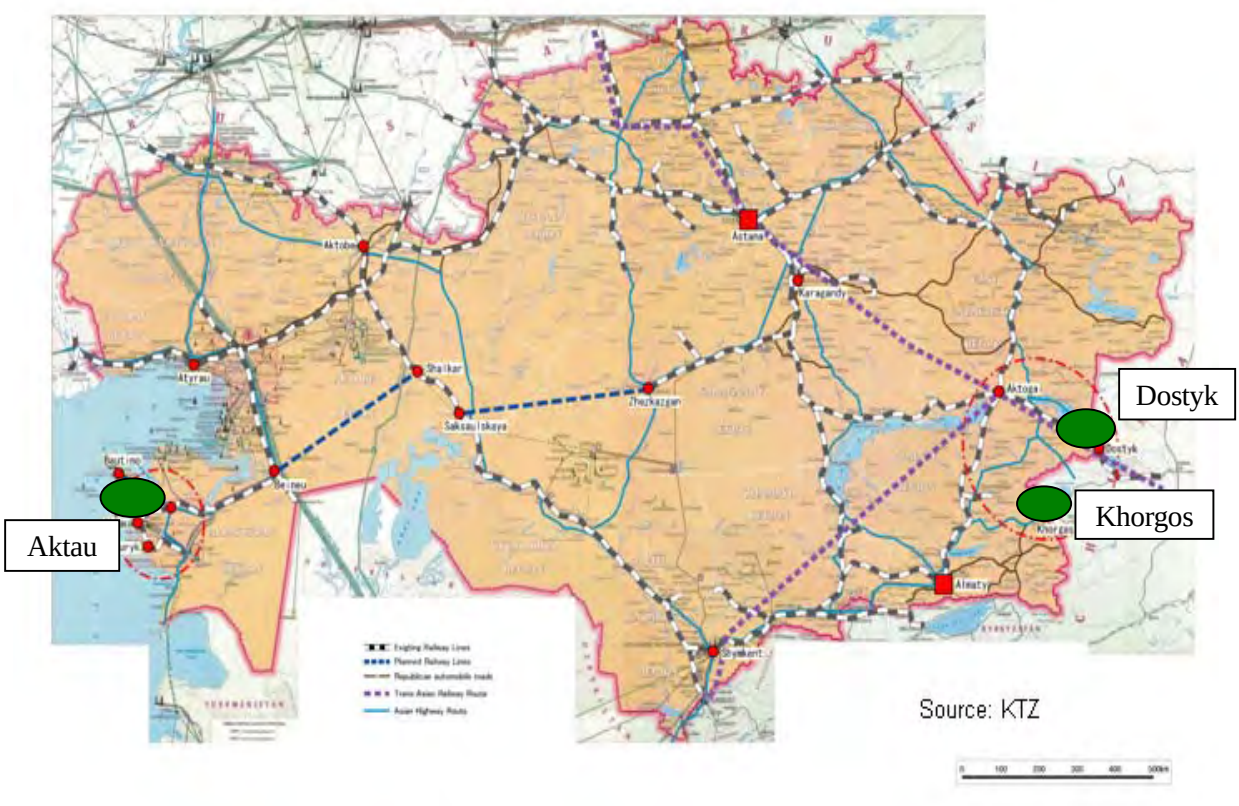


Figure 10.3-1 Location of the Freight Traffic Survey

10.3.2 Cargo Movement Survey

(1) Scope of Cargo Movement Survey

The cargo movement survey is conducted by questionnaire to get an idea of cargo movement by railway and road transportation. The OD survey including cargo volumes, commodity types and origin-destination of each freight fleet is arried out in a field survey. The detailed items for study are as follows.

- The survey in winter will be conducted for 2 days on weekdays (1st, 2nd February) and for 1 day on a weekend (3rd February).
- The survey is preferably carried out by transcribing shipping documents to survey forms so as to collect the necessary information at cross-border check points.
- The field survey work will collect raw data. The data will then be enumerated in accordance with the following data items.
  - A) Survey point No./ Date / Time
  - B) Cargo weights measured in tons
  - C) Commodity type (see Table 10.3-1)
  - D) The place (Oblasts in Kazakhstan and countries outside Kazakhstan) to where consignor dispatched cargo
  - E) The place (Oblasts in Kazakhstan and countries outside Kazakhstan) where consignee receives the cargo
  - F) Type of train (container or non-container)
  - G) Type of vehicle in case of transport by vehicle

Table 10.3-1 Commodity Type Categories

Code	Commodity Type
a)	Agricultural products (Rice, Vegetables, Fruits, etc)
b)	Forest(Logs, Timber, Plywood, etc)
c)	Mineral resources (coal, iron ore, copper, etc)
d)	Oil and natural gas
e)	Metal & Machine (Steel, generators, cars, motorcycles, etc.)
f)	Construction materials (Sand, cement, wood products, etc.)
g)	Light industry /electronics (Electronic appliances, Machine parts, IC related equipment, etc.)
h)	Consumer goods (Garments, shoes, etc.)
i)	Others

(2) Number of Survey Samples Collected

The number of samples collected is shown in Table 10.3-2.

Table 10.3-2 Number of Samples Collected

	1 Feb.	2 Feb.	3 Feb.	Total	Remarks
Dostyk	655	811	911	2,454	No. of Trains
Aktau	2,813	3,151	3,652	9,616	No. of Trains
Khorgos	115	105	96	316	No. of Trucks

(3) Schedule and Delay Survey

The Schedule and Delay Survey is conducted to track the actual time schedule at each checkpoint (ex.

stations, border) of railway freight traffic passing through Dostyk Station. The Schedule and Delay Survey includes basic information on cargo, arrival/departure time and the reason for stop/delay at each checkpoint, by field survey or shipping documents. The detailed items for study are as follows.

- 50 cargos from 5 freight fleets from China to Almaty, Astana, or Aktau in Kazakhstan.
- 10 cargos from each freight fleet

The survey items are as follows.

- Commodity type and tonnage
- Origin of container
- Destination of container
- Transport route (or main station on the route)
- Stopping point (checkpoint)
- Freight fleet number (check every change of freight fleet)
- Arrival time at each checkpoint
- Departure time at each checkpoint
- Main reason of delay at checkpoint

(4) Operation Time Survey at Dostyk Station

The operation time survey is conducted to study the detailed procedure for freight fleets and cargos handled at Dostyk Station and register the time and reasons for delay in each procedure. The detailed items for study are as follows.

- Detailed procedure for customs, train transfer operation and shunting, by interview survey with Dostyk Station operators
- Time and reasons of delay from train receipt and shunting to dispatch, including customs clearance
- More than 40 cargos at Dostyk Station

10.3.3 Analysis of Freight Traffic at Dostyk Terminal

(1) Cargo movement in February 2007

1) Daily volume by survey date at Dostyk Station

The daily volume of cargos at Dostyk Station is 16,000 tons per day on the weekend and 22,000 tons on weekdays. By commodity type, “Minerals” and “Oil and Gas” account for 70% of total volume. For cargos handled on weekdays, the largest share of commodity type belongs to “Minerals” (47%), and “Oil and Gas” constitutes 23%. On the weekend, 48% of the total cargos are “Oil and Gas.”

Table 10.3-3 Daily Volume at Dostyk Station

Commodity Type	Weekday		Weekend	
	Total Weight (ton/day)	Share (%)	Total Weight (ton/day)	Share (%)
Agri. Products	733	3.3%	1,086	6.7%
Forest	546	2.4%	-	0.0%
Minerals	10,531	47.0%	4,708	28.9%
Oil and Gas	5,041	22.5%	7,863	48.3%
Metal and Machines	3,728	16.7%	1,463	9.0%
Construction Materials	327	1.5%	-	0.0%
Electronics	-	0.0%	-	0.0%
Consumer Goods	45	0.2%	36	0.2%
Others	1,434	6.4%	1,129	6.9%
Total	**22,385**	**100.0%**	**16,285**	**100.0%**

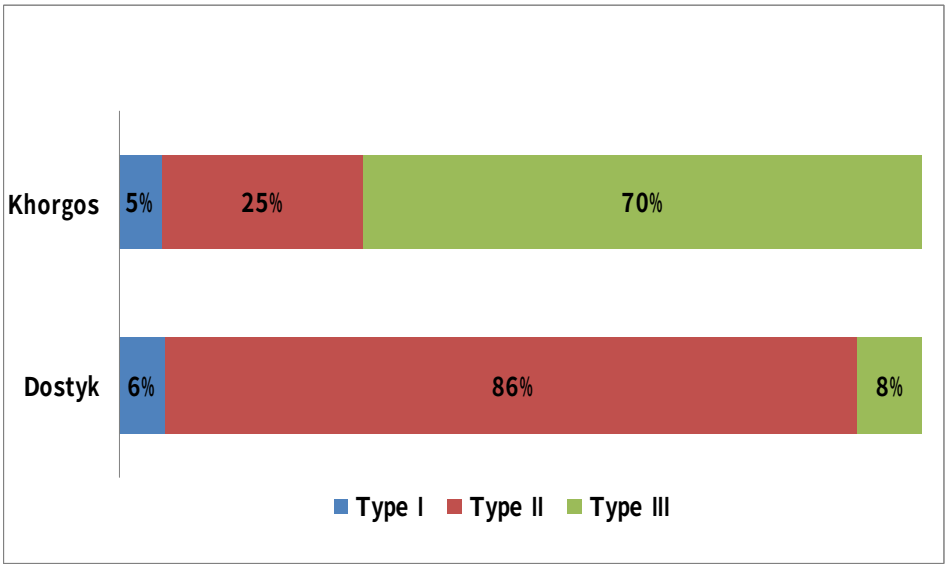
(2) Comparison of Dostyk and Khorgos

The daily volume of cargo handling in Khorgos is about 1,200 tons per day on the weekend, which is only 5% of cargo handled at Dostyk terminal. By commodity type share, Type II (Minerals, Oil and Gas, etc.) is very high at Dostyk and Type III (Consumer Goods, etc.) is very high at Khorgos.

- Dostyk : 22,385 tons/day (95%)
- Khorgos : 1,209 tons/day (5%)

Table 10.3-4 Daily Cargo Volume at Khorgos

Commodity Type	Total Weight (ton/day)	Share (%)
Agri. Products	37	3.1%
Forest	25	2.1%
Minerals	-	0.0%
Oil and Gas	20	1.7%
Metal and Machines	286	23.7%
Construction Materials	110	9.1%
Electronics	75	6.2%
Consumer Goods	233	19.3%
Others	422	34.9%
Total	**1,209**	**100.0%**



Type I: Agricultural and Forestry Products
Type I: Minerals, Oil and Gas, Metal and Machines
Type III: Construction Materials, Electronics, Consumer Goods, Others

Figure 10.3-2 Ratio of Daily Goods Volume by Commodity Type

(3) Average Weight of Cargo

The average weight per cargo is about 61 tons for all commodity types. Commodity type "Minerals" accounts for the largest weight of about 69 tons, followed by "Metals and Machines" at 61 tons.

Table 10.3-5 Average Weight per Cargo at Dostyk Station

Cpmmodity Type	Ave. Weight (kg/cargo)	No. of Cargo
Agri. Products	44,443	33
Forest	57,505	19
Minerals	68,608	307
Oil and Gas	58,611	172
Metal and Machines	61,108	122
Construction Materials	50,261	13
Electronics	-	-
Consumer Goods	44,771	2
Others	50,322	57
Total	61,751	725

(4) Daily volume by import and export

In terms of daily import and export volume, import volume is 20,000 tons, accounting for a high share compared with export of 2,300 tons. The main commodity type is "Minerals" with a 50% share of export volume. The largest share of total export volume is "Oil and Gas," with about 80%.

Table 10.3-6 Daily Volume by Import/Export at Dostyk Station (Weekday)

Commodity Type	Import		Export	
	Total Weight (ton/day)	Share (%)	Total Weight (ton/day)	Share (%)
Agri. Products	-	0.0%	733	3.7%
Forest	28	1.2%	519	2.6%
Minerals	-	0.0%	10,531	52.4%
Oil and Gas	1,852	80.3%	3,189	15.9%
Metal and Machines	76	3.3%	3,651	18.2%
Construction Materials	327	14.2%	-	0.0%
Electronics	-	0.0%	-	0.0%
Consumer Goods	23	1.0%	22	0.1%
Others	-	0.0%	1,434	7.1%
Total	**2,306**	**100.0%**	**20,079**	**100.0%**

Source: JICA Study Team

(5) Cargo Origin/Destination Matrix

In terms of cargo origin and destination country, cargo from Kazakhstan to China has the largest volume at 17,800 tons per day, accounting for 70% share of all cargo volume handling per day at Dostyk Terminal. For cargos in Khorgos, imports from China to Kazakhstan account for about 700 tons per day, with a 60% share.

Table 10.3-7 Cargo Origin/Destination Matrix at Dostyk Station (Weekday)

unit :ton/day

O	Kazakh.	China	Kyrgyz	Tajikistan	Uzbekistan	Russia	**Total**
Kazakh.	-	17,769	-	-	-	-	**17,769**
China	1,480	-	-	22	53	750	**2,305**
Kyrgyz	-	-	-	-	-	-	**-**
Tajikistan	-	-	-	-	-	-	**-**
Uzbekistan	-	755	-	-	-	-	**755**
Russia	-	1,556	-	-	-	-	**1,556**
Total	**1,480**	**20,080**	**-**	**22**	**53**	**750**	**22,385**

Source: JICA Study Team

Table 10.3-8 Cargo Origin/Destination Matrix at Khorgos (Weekday) unit: ton/day

O	Kazakh.	China	Russia	Tajikistan	Turkmen.	Georgia	Other CIS	**Total**
Kazakh.	8	31	-	-	-	-	-	**39**
China	699	-	168	81	0	6	79	**1,034**
Russia	-	115	-	-	-	-	-	**115**
Tajikistan	-	13	-	-	-	-	-	**13**
Turkmen.	-	-	-	-	-	-	-	**-**
Georgia	-	-	-	-	-	-	-	**-**
Other CIS	-	8	-	-	-	-	-	**8**
Total	**708**	**166**	**168**	**81**	**0**	**6**	**79**	**1,209**

Source: JICA Study Team

(6) Transit cargo passing through Kazakhstan

In terms of transit cargo passing through Kazakhstan, transit from Kazakhstan to China at Dostyk Terminal accounts for 14% with 3,100 tons per day. At Khorgos, cargo transit from China to Kazakhstan has a high share of 58% with 700 tons per day.

Table 10.3-9 Transit Cargo Share at Dostyk and Khorgos (Weekday)

	Dostyk		Khorgos	
	Cargo tonnage (ton)	Share (%)	Cargo tonnage (ton)	Share (%)
1) From Kazakhstan to China	17,769	79.4	39	3.2
2) From China to Kazakhstan	1,480	6.6	699	57.8
3) Transit (through Kazakhstan)	3,136	14.0	471	39.0
Total	22,385	100.0	1,209	100.0

Source: JICA Study Team

10.4 Freight Traffic Demand Forecast

10.4.1 Existing Freight Traffic Demand

Tables 10.4-1 and 10.4-2 show existing freight traffic demand at Dostyk Station. According to these tables, freight traffic volume at Dostyk Terminal in 2005 was 11.1 million tons and in 2006 was 13.0 million tons, a growth rate of 17%.

As for type of cargo, export and transit cargos to China are predominantly bulk cargos such as oil and metal goods, while import and transit cargos from China are non bulk cargos.

Table 10.4-1 Freight Traffic at Dostyk Station in 2005 and 2006

Commodity	2005 (ton)	2006 (ton)	2006/2005 (%)	Commodity	2005 (ton)	2006 (ton)	2006/2005 (%)
Export				Import			
Ferrous metals	1,259,076	963,140	-23.5	Equipment hardware	87,661	116,703	33.1
Pellets	1,967,022	3,670,880	86.6	Food	82,315	82,999	0.8
Chemicals	239,632	430,053	79.5	Tea	39,308	32,700	-16.8
Oil products	1,708,435	1,921,822	12.5	Tobacco	6,133	1,582	-74.2
Concentrated manganese			-	Chemicals	184,697	230,084	24.6
Scrap metal	1,709,815	617,124	-63.9	Containers	530,580	1,229,219	131.7
Cotton	111,985	227,124	102.8	Construction materials	237,064	513,638	116.7
Non-ferrous metals	416,146	327,523	-21.3	Coke	441,565	451,012	2.1
Non-ferrous ore	474,311	920,970	94.2	Non-metal ore	1,123		-100
Non-metal ore	14,490	22,930	58.2	Gasoline	62,478		-100
Containers	100,166	125,636	25.4	Ferrous metals	157,060	208,678	32.9
Fertilizers	503,308	354,351	-29.6	Consumer goods	44,671	49,449	10.7
Timber	79,695	89,827	12.7	Toluene		1,139	-
Alumina	152,492	100,268	-34.2	Cotton	242		-100
Equipment hardware	219,078	57,861	-73.6	Cereals	2,863	19,526	582
Concentrated iron ore			-	Non-ferrous metals	1,321	9,212	597.4
Chrome ore	78,822	14,719	-81.3	Other	123,790	172,811	39.6
Other	36,934	23,247	-37.1				
Total	9,071,407	9,867,475	8.8	Total	2,002,871	3,118,752	55.7
by Container	100,166	125,636	25.4	by Container	530,580	1,229,219	131.7
	1.10%	1.30%	15.30%		26.50%	39.40%	48.80%
Non-Container	8,971,241	9,741,839	8.6	Non-Container	1,472,291	1,889,533	28.3

Source: KTZ

Table 10.4-2 Growth Rate of Freight Traffic Demand at Dostyk Station

(Unit: '000 Ton)

		2005	2006	2006/2005
Export	To China	7,890	8,581	1.09
Import	To Kazakhstan	1,184	1,722	1.45
Transit	To China	1,181	1,286	1.09
	To Kazakhstan	819	1,397	1.71
Total	To China	9,071	9,867	1.09
	To Kazakhstan	2,003	3,119	1.56
Total		11,074	12,986	1.17

Source: KTZ

The containerization rate for cargos to China (all cargo) in 2005 was very low (1%), while the rate for cargos from China to Kazakhstan was 27 %.

10.4.2 Socio-Economic Framework in Kazakhstan and Neighboring Countries

Prior to the forecast of freight traffic volume, the socio-economic framework of Kazakhstan and the neighboring countries is forecast based on the IMF forecast. Table 10.4-3 shows the economic growth rates assumed to forecast the freight traffic demand.

Table 10.4-3 Forecast of Economic Growth Rates in Kazakhstan and its Neighboring Countries

(Unit: %)

Countries	2005	2006	2007-'10	2011-2017
Kazakhstan	9.4	8.3	7.4	8.3
China	9.9	10.0	9.0	7.0
Russia	25.3	5.5	5.5	5.5
Kyrgyzstan	-0.6	5.0	5.5	5.5
Tajikistan	6.4	7.5	6.0	6.0
Uzbekistan	7.0	7.2	5.0	4.8
Turkmenistan	9.6	6.5	6.0	6.0

Source: JICA Study Team, based on IMF forecast.

Table 10.4-4 shows the economic growth rates adopted for freight traffic demand forecast for each type of cargo.

Table 10.4-4 Summary of Forecast Economic Growth Rates for Export, Import and Transit Cargos

(Unit: %)

Type	Direction	2006	2007-'10	2011-2017
Export	To China	10.0	9.0	7.0
Import	To Kazakhstan	8.3	8.3	8.3
Transit	To China	6.3	5.6	5.6
	To Kazakhstan	6.3	5.6	5.6

Source: JICA Study Team

10.4.3 Future Freight Traffic Demand

Future freight traffic demand is forecast using economic growth rates with elasticity according to the following formula:

$$D^{fy} = D^{2006} \times (1+G * \varepsilon)^{(fy - 2006)}$$

Where: D^{fy} = Future year freight traffic demand

D^{2006} = Freight traffic demand in 2006

G = Economic growth rate

ε = Elasticity of freight traffic growth to economic growth

Table 10.4-5 shows assumed elasticity rates of freight traffic growth to economic growth rate based on the JICA Study Team's last experiences adopted for various countries.

Table 10.4-5 Elasticity of Freight Traffic Growth to Economic Growth

Type	Direction	2006	2007-'10	2011-2017
Export	To China	0.97	0.35	0.33
Import	To Kazakhstan	6.26	4.20	0.88
Transit	To China	0.98	0.35	0.33
	To Kazakhstan	6.55	4.20	0.88

Source: JICA Study Team

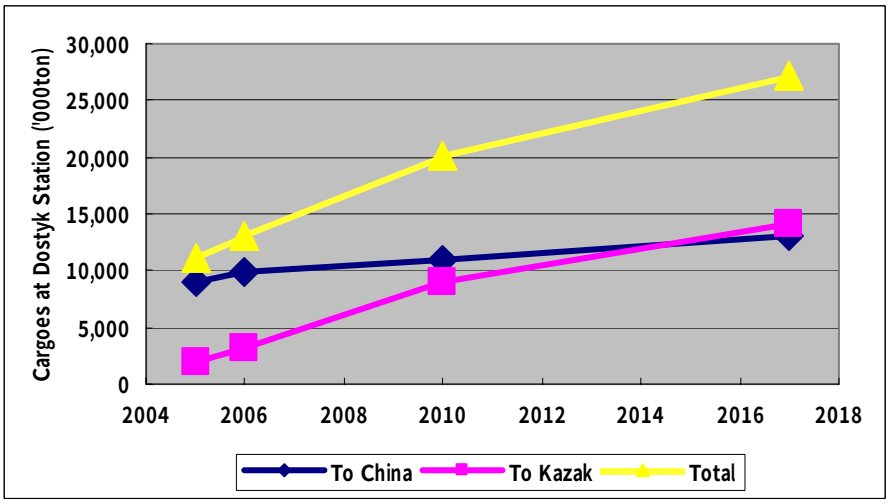
Following the formula mentioned above, future freight traffic demand at Dostyk Terminal is forecast and shown in Table 10.4-6. According to this table, freight traffic demand is expected to increase from 13.0 million tons in 2006 to 19.1 million tons in 2010 and 24.2 million tons in 2017. It is noted that import and transit cargos from East Asia such as Japan, Korea, China, etc. are expected to increase tremendously, while export and transit cargos to East Asia are expected to increase steadily.

Table 10.4-6 Forecast for Freight Traffic Demand at Dostyk Terminal

(Unit: '000 ton)

		2005	2006	2010	2017	2017/2006
Export	To China	7,890	8,591	9,720	11,429	1.33
Import	To Kazakhstan	1,184	1,862	6,151	10,097	5.42
Transit	To China	1,181	1,276	1,380	1,571	1.23
	To Kazakhstan	819	1,257	2,929	4,103	3.26
Total	To China	9,071	9,867	11,100	13,000	1.32
	To Kazakhstan	2,003	3,119	9,080	14,200	4.55
Total		11,074	12,986	20,180	27,200	2.09

Source: JICA Study Team



Source: JICA Study Team

Figure 10.4-1 Forecast for Freight Traffic at Dostyk Terminal

10.4.4 Container Cargos

(1) Container Cargos in Terms of Volume

Looking at world trends in cargo movements, containerization is progressing rapidly. This is largely due to shorter transport time and ease of loading and unloading. In Japan, almost 100% of freight traffic by railway is transported by containers. In China, containerization is rapidly progressing. Taking into account such situations, two (2) scenarios for freight traffic at Dostyk Terminal are considered as follows.

- Scenario 1: Existing Level of Containerization
- Scenario 2: Containerization rate at double the existing level

Results of the containerized freight traffic forecast show that container freight traffic at Dostyk Terminal is expected to increase from 1.36 million tons in 2006 to 4.31 million tons in the case of Scenario 1 and 4.87 million tons in the case of Scenario 2 in 2010, and to 7.49 million tons in the case of Scenario 1 and 9.17 million tons in the case of Scenario 2 in 2017.

Table 10.4-7 Assumed Containerization by Scenario

(Unit: %)

	2005	2006	2010	2017
Scenario 1				
To China	1.1	1.3	2.0	3.0
To Kazakhstan	26.5	39.4	45.0	50.0
Scenario 2				
To China	1.1	1.3	3.0	5.0
To Kazakhstan	26.5	39.4	50.0	60.0

Source: JICA Study Team

Table 10.4-8 Container Traffic Volume Forecast under 2 Scenarios

(Unit: '000 ton)

	2005	2006	2010	2017	2017/2006
Scenario 1					
To China	100	126	220	390	3.10
To Kazakhstan	531	1,229	4,086	7,100	5.78
Total	631	1,355	4,306	7,490	5.53
Scenario 2					
To China	100	126	330	650	5.16
To Kazakhstan	531	1,229	4,540	8,520	6.93
Total	631	1,355	4,870	9,170	6.77

Source: JICA Study Team

(2) Container Cargos in Terms of TEU

Table10.4-9 shows container cargos in terms of TEU.

For the results of container freight traffic forecast in terms of TEU, the following observations can be made:

1) Container freight traffic in both directions at Dostyk Terminal is expected to increase from 140 thousand TEUs to 400,000 TEUs in 2010 and 698,000 TEUs in 2017 if the containerization rate is under Scenario1.
2) In this Scenario, 50-car block container trains are operated between Dostyk and Almaty three (3) times per day in 2010 and six (6) times per day in 2017.

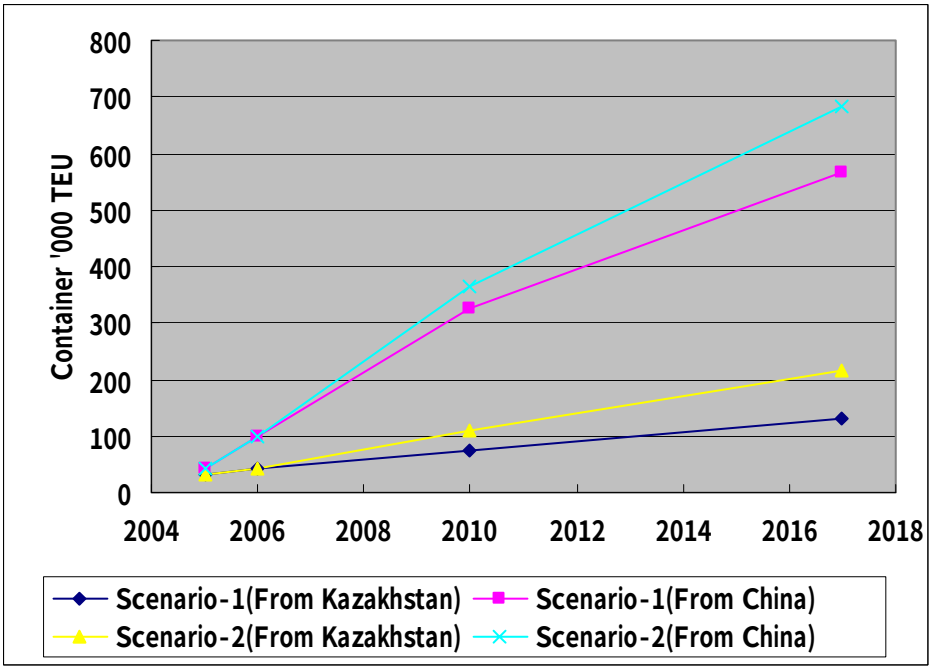
3) Container freight traffic is expected to increase to 473,000 TEUs in 2010 and 898,000 TEUs in 2017 if containerization is under Scenario 2.
4) In the second Scenario, 50-car block container trains are operated between Dostyk and Almaty four (4) times per day in 2010 and twelve (12) times per day in 2017.

Table 10.4-9 Container Traffic Demand Forecast by Scenarios

(Unit: '000 TEU)

		2005	2006	2010	2017	2017/2006
Scenario 1	Export	33	42	73	130	3.10
	Import	42	98	327	568	5.78
	Total	76	140	400	698	4.97
Scenario 2	Export	33	42	110	217	5.16
	Import	42	98	363	682	6.93
	Total	76	140	473	898	6.40

Source: JICA Study Team



Source: JICA Study Team

Figure 10.4-2 Forecast for Container Cargoes in terms of TEU

10.5 Concept Plan for Dostyk Terminal

Based on the overall field survey carried out and the future freight traffic demand forecast, operation at Dostyk Terminal is generally good and efficient. However, the following problems and issues were also identified:

1) Dostyk Station has 8 reloading spots, from No. 1 to No. 7 including No. 4A.
   Spots No.1, No.4A and No. 7 are in the open air. Because of the snowfall and fierce wind in winter, the operation of cranes, forklifts, etc. for loading and unloading sometimes has to be stopped and cargo handling work becomes impossible.
   It is preferable that the cargo handling work using cranes, etc. be carried out inside a building.
2) Some of the cargo handling equipment requires overall repair, lacking spare parts or broken. The equipment does not match the current cargo volume. And the future increase in cargo cannot be handled by the current handling equipment. Because of the lack of cargo handling equipment capacity, improvement is necessary.
3) The current cargo handling amount has reached 80% or 90% of capacity at Dostyk Station and is almost equal to capacity. Taking the variation in period into consideration, there would be cases when the cargo amount exceeds capacity.
   Therefore, early improvement of this bottleneck is required.
4) As described above in Freight Traffic Demand Forecast at Dostyk Terminal, future cargo volume at Dostyk Station will show a major increase from 13.0 million tons in 2006 to 20.2 million tons in 2010 and 27.2 million tons in 2017.
   If Dostyk Station remains as it is, a huge amount of freight cargo stoppage will occur and Dostyk Station will be an obstacle preventing the Kazakhstan economy from improving.
5) As described above in Freight Traffic Demand Forecast at Dostyk Terminal, future container cargo volume (import and transit) is estimated to show a major increase from 57,000 TEUs in 2006 to the following:
   Scenario 1; 327,000 TEUs in 2010 and 568,000 TEUs in 2017
   Scenario 2; 363,000 TEUs in 2010 and 682,000 TEUs in 2017
   If no improvements are made to Dostyk Station, a huge amount of container cargo stoppage will occur.
   At present, only No. 4 and No. 4A spots can be used for loading and unloading of containers.
   And No. 4 spot can only take 26 container wagons.
   In the future, taking block trains into consideration, facilities for each length of 50 container wagons will be necessary.
6) To handle the future cargo amount, not only improvement of Dostyk Station but also reinforcement of capacity between Dostyk Station and Aktogay Station is necessary. Improvement of Aktogay Station is also necessary.

10.6 Preliminary Design of Dostyk Terminal

Based on the overall field survey and demand forecast, focusing on Dostyk Station as a bottleneck in the traffic flow, the improvement plan aiming to increase of transport efficiency and capacity has been prepared.

The existing and improved facilities are to be used for the operation of block trains.

Cargo amounts including container cargos at Dostyk Station (million tons/year) are as follows.

- 2006: 13.0 million tons
- 2010: 20.2 million tons
- 2017: 27.2 million tons

Future container cargos (thousand TEUs/year) are as follows.

- Scenario 1: 2006; 57,000 TEUs, 2010; 327,000 TEUs, 2017; 568,000 TEUs
- Scenario 2: 2006; 57,000 TEUs, 2010; 363,000 TEUs, 2017; 682,000 TEUs

10.6.1 Layout Plan and Preliminary Design of Each Facility

The layout plan and facility design has been prepared taking the following conditions into account:

* Demand forecast result for Scenario 1 in the short term,
* Improvement of wagon delays so as to eliminate bottlenecks,
* Attainment of higher work efficiency, and
* New railway line plan between new Khorgos terminal and Saryozek Station scheduled to be completed by 2012.

Regarding the new railway line, it appears that role assignment between the existing and new routes will be determined according to cargo destinations. Therefore, it will be necessary to reexamine the plan in 2012. (Figure 10.6-1)

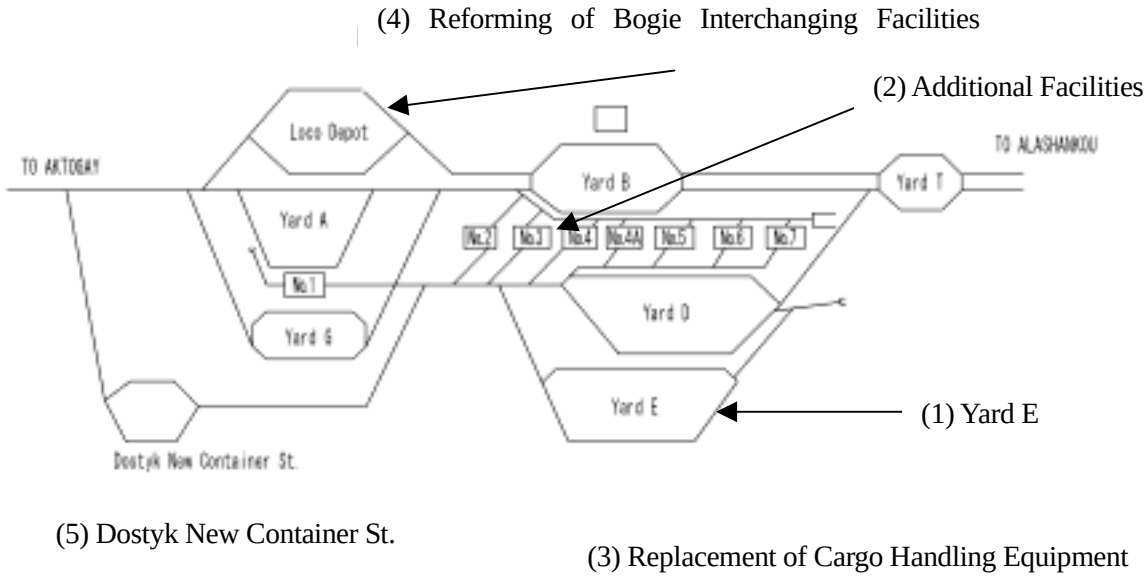


Figure 10.6-1 Layout of Dostyk Station

(1) Construction of yard E (narrow gauge)

Current yard D (standard gauge) is used for freight inspection and marshalling of wagons which arrive from China. However, due to time taken for inspection work and obstructions to train traffic at the entrance of marshalling work, yard D is a bottleneck and always congested, and wagons stay have occurred. Therefore, yard E exclusively marshalling is newly established in a vacant lot to the south of current yard D. Yard D is

used only for inspection. Improved efficiency and smooth operation can be obtained by separating marshalling and inspection functions. (Figure 10.6-2)

The facilities are as follows.

*Total rail track: 9,100m
*Switch: 23 units
*Signal device: one set

From the east : Entrance to yard D

From the west: Railway for incoming trains from China; drill track is seen on the far right side

From the east: yard D exit

From the west: yard D exit

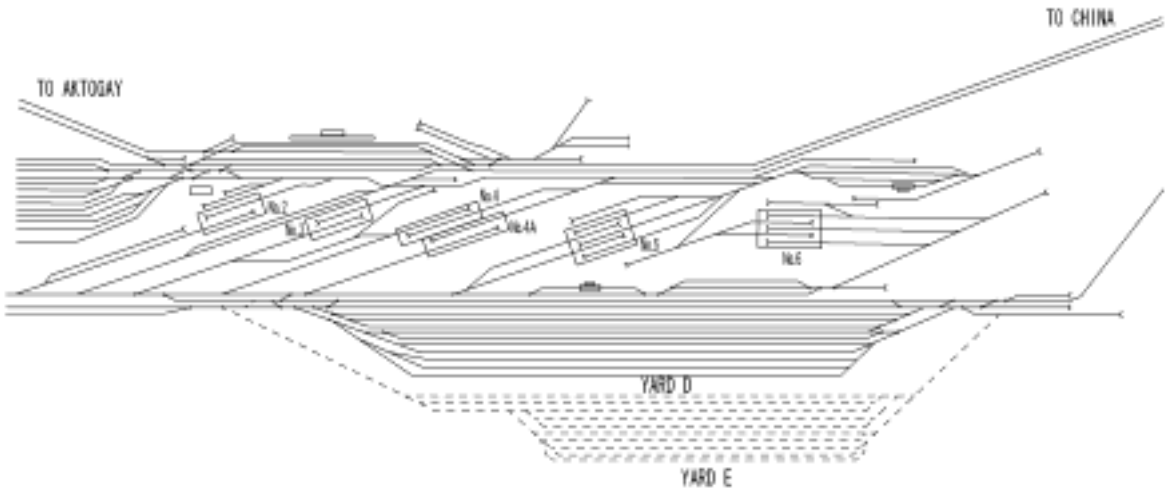


Figure 10.6-2 Track Layout Plan of Yard

(2) Additional establishment of container trans-loading hangar

Although container trans-loading work is performed at hangar No. 4 (indoors) and yard No.4A (outdoors), delays have arisen due to shortage of capacity. Therefore, an additional equivalent hangar in parallel is newly established on vacant land to the north of current hangar No. 4. Narrow and broad gauge tracks are constructed and capacity is increased. However, due to the lack of space between the current tracks on the north, the new hangar is smaller and narrower than the present one. Specifically, if the hangar is 22m wide, its maximum length would be restricted to 358m.

For reference, sexchanging to new cranes would increase efficiency up to 140% compared those currently used. With the addition of a container trans-loading hangar, total capacity of the additional hangar and existing hangar No. 4 would be 223,200 TEUs/year. (Figure 10.6-3)

2 x 79716 x 1.4 = 223,200

On the other hand, the capacity of No. 4A will be 132,860 TEUs/year .

94,900 x 1.4 = 132,860

The total capacity will be 356,060 TEUs/year. This is enough to meet the estimated demand forecast.

The additional facilities are as follows.

* One hangar building: (length, 358m; width, 22m), 7,876m^2
*Track (broad gauge): length, 450m
*Switch: 1 unit
*Track: (narrow gauge) length, 420 m
*Switch: 1 unit
*Pavement: (8X358) 2,864 m^2
*OHBC (overhead bridge crane)

From the west: Loading and unloading facility No. 4

From the west: Northern side of loading and unloading facility No. 4

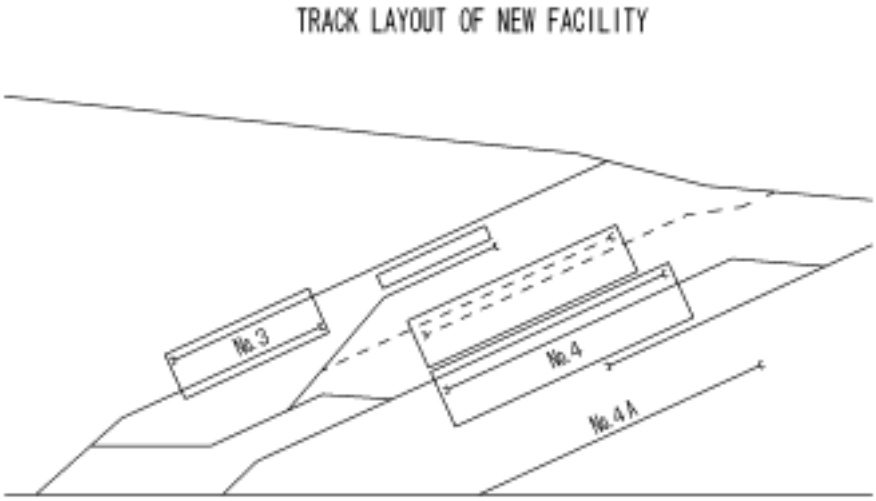


Figure 10.6-3 Track Layout Plan of New Facility

(3) Replacement of Cargo Handling Equipment

As shown in Table 10.6.-1, almost all cargo handling equipment is superannuated; and there are also many pieces of equipment not in operation because of breakdowns. Updating the equipment will increase efficiency and capacity. Moreover, a maintenance organization is established to reduce equipment down time. It is recommended to update by acquiring new, not used, equipment. (Details are shown in Table 10.6-1)

Cargo Handling Equipment in Dostyk

Location	No.	Name	Purpose	Capacity (ton)	Manufacture	Issue year	Initial cost (tenge)	Condition
No.1	1	Mobile crane KC4562	Piece cargo transloading	20	Kraz	1991	3,856,800	
	2	Crane KC-5363D	ditto	36		1992	8,779,500	
	3	Crane KC-5363D	ditto	36		1992	8,779,500	
	4	Crane KC-5363A	ditto	25				
	5	Crane KC-45721	ditto	20				
	6	Crane KC-45721	ditto	20				
	7	Crane KC-3563	ditto	16	Kamaz			
No.2	1	Electric Loader (Forklift track)	Piece cargo transloading	1.5		1998	1,810,200	Broken: not in operation since 2002
	2	ditto	ditto	1.5		1998	1,810,200	ditto
	3	ditto	ditto	1.5		1998	1,810,200	ditto
	4	ditto	ditto	1.5		1998	1,810,200	ditto
	5	ditto	ditto	1.5		1998	1,810,200	ditto
	6	ditto	ditto	1.5		1994	1,810,200	ditto
	7	ditto	ditto	1.5		1994	1,810,200	ditto
	8	ditto	ditto	1.5		1994	1,810,200	ditto
	9	Diesel Loader (Forklift track)	ditto	1.5-3.0	Toyota			
	10	ditto	ditto	1.5-3.0	Toyota			
	11	ditto	ditto	1.5-3.0	Toyota			
	12	ditto	ditto	1.5-3.0	Toyota			
	13	ditto	ditto	1.5-3.0	Toyota			
No.3	1	Diesel Loader (Forklift track)	Piece cargo transloading	1.5-3.0	Toyota			
	2	ditto	ditto	1.5-3.0	Toyota			
	3	ditto	ditto	1.5-3.0	Toyota			
	4	ditto	ditto	1.5-3.0	Toyota			
	5	ditto	ditto	1.5-3.0	Toyota			
	6	ditto	ditto	1.5-3.0	Toyota			
	7	ditto	ditto	1.5-3.0	Toyota			
	8	ditto	ditto	1.5-3.0	Toyota			
	9	ditto	ditto	1.5-3.0	Toyota			
	10	ditto	ditto	1.5-3.0	Clark			
	11	ditto	ditto	1.5-3.0	Clark			
No.4	1	Overhead Crane	Container transloading	30.5		1994	3,027,841	Broken: half coupling
	2	Overhead Crane	Container transloading	30.5		1994	2,884,773	
No.4a	1	Reach Stacker	Container and heavy cargo	41	SISU	1997	10,030,400	Broken: not in operation
	2	Reach Stacker	Container and heavy cargo	45	SMV	2003	12,300,000	
No.7	1	Rail Mounted Gantry Crane	Heavy cargo	50		2005	32,000,000	
	2	Rail Mounted Gantry Crane	Heavy cargo	30		2006	28,000,000	

*All equipment has purchased as secondhand.

Source: KTZ Dostyk Station

Table 10.6-1 Cargo Handling Equipment at Dostyk Terminal

(4) Reforming of Bogie Interchanging Facilities

Passenger coaches, tank wagons or others cannot be transloaded because the nature of the cargo necessitates interchanging bogies. A new large-scale hangar for interchanging bogies of cargo wagons is being built now to the southeast of the existing facilities. After completion at the end of 2007, the new facilities will be exclusively for use of cargo wagons and not for passenger coaches. With the interchanging work shifted to the new facility, interchanging for passenger trains only will be done at the existing facility. The current facility does not have a long enough rail track and jack to handle 10 passenger coaches. Commonly, passenger coaches are operated in 12-coach formation. Therefore, interchanging work needs coupling and uncoupling of the train every time. This is not efficient. The existing track length for ten wagons should be extended two wagons more, that is, about 50m to the west. Jacks for extension can be shifted from the other existing one. Extending the track westward is better than going to the east. In the eastward area, there is a crossing and not enough space to align the track and improve the gradient. The area to the west has enough flat space to align tracks and so it can be extended easily at low cost. (Figure 10.6-4)

From the east: Bogie interchanging facilities

From the west: Level crossing to the east of the bogie interchanging facilities

From the east: Bogie interchanging facilities

Train from China to Almaty

Sign on the train

The train is going for loading and unloading work.

Details of construction for extension are as follows.

*Total rail construction: 300 m

*Switch: 4 units

*Shifting jacks required for2 wagons

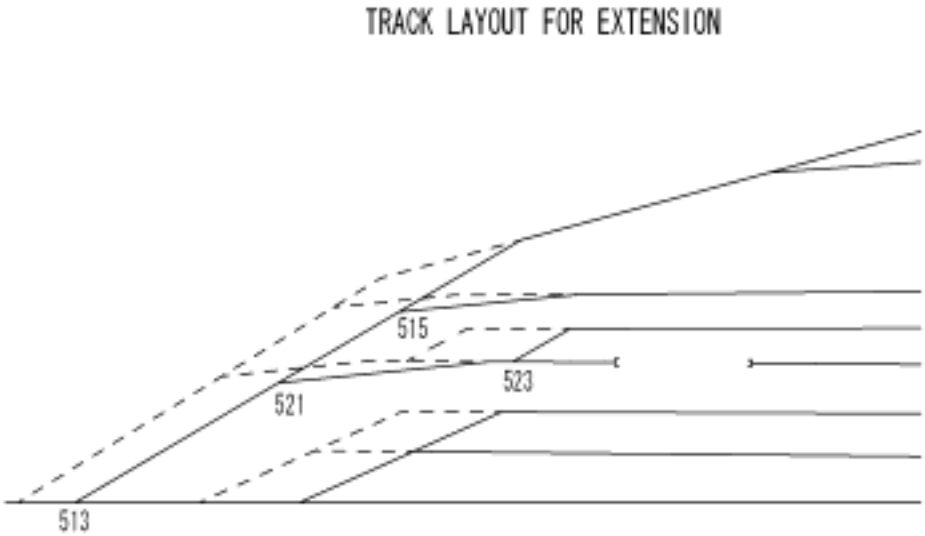


Figure 10.6-4 Track Layout Plan for Extension

(5) Conceptual Plan for a New Dostyk Container Station

Over the medium-to-long term, the above-mentioned expedients for improvement will not be enough to meet the huge increase in demand. At the present stage, the plan proposes to establish a new Dostyk container station 9km to the west from the current terminal. However, it seems that reexamination of the plan is needed with relation to the new Khorgos Terminal and the conceptual plan for the Second Dostyk

New terminal about 80 km from the current terminal in 2012.

For reference, changing to new cranes will increase the efficiency of No. 4 up to 140% compared to now.

The capacity of a new Dostyk container station will be 502,210 TEUs/year. (Figure 10.6-5)

2 x 900/400 x 79716 x 1.40 = 502,210 TEU/year

Total capacity including section (2) about No. 4, etc. will be considerably increased to 858,270 TEUs/year.

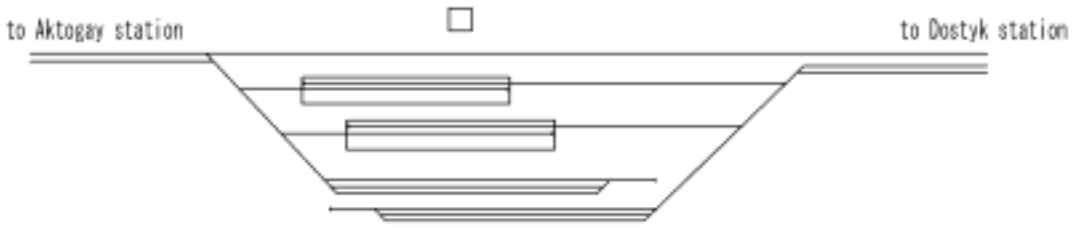


Figure 10.6-5 Track Layout Plan for a Dostyk New Container Station

Phase 2 Plan:

The main elements of the plan for trans-loading containers on platform wagon or open wagon 1,435 mm gauge track from/to wide track are as follows.

-Two sheds: each one 900 m in length and 27m in width having two different-gauge tracks and extra space about 12 m wide

- 4 open platforms: 4 lanes x 20,000 m^2

-Three 1,520 mm gauge tracks for arrival and departure of trains

-One 1,520 mm gauge drill track

-8 turnouts

-Single 1,435 mm gauge track from the current Dostyk Station to Dostyk New Container Station

-Three 1,435 mm gauge tracks for arrival and departure of trains

-One 1,435 mm gauge drill track

-7 turnouts

-Signal and telecommunication

-Container center: 2F, 20m x 60m x 2

- Access road: 9,000 m

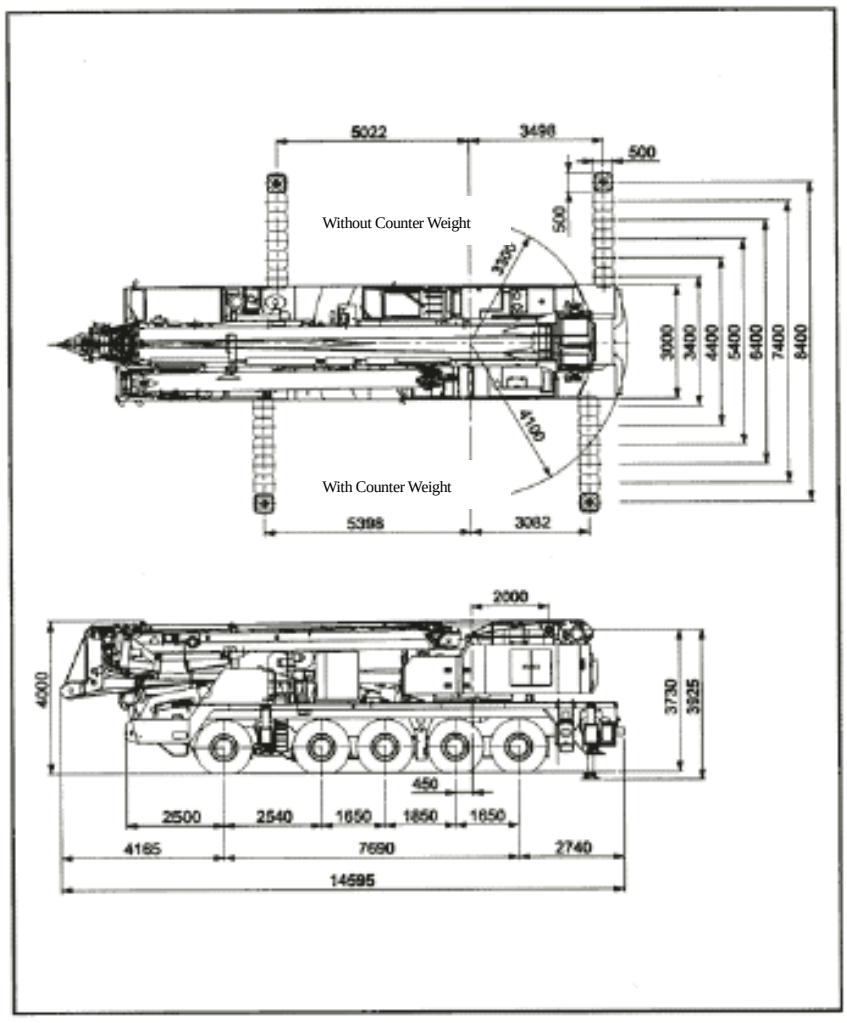
4 overhead cranes with 50-ton capacity

10.6.2 Preliminary Design of Equipment

Details of each piece of handling equipment recommended for replacement are shown below.

(1) Mobile Crane

The mobile crane is used for trans-loading cargo from/to flat wagons or open wagons. This machine has tires so that it can move between facilities, i.e., No. 1 to No. 7, etc. and flexible operation is possible. Since heavy vehicles such as construction machinery are increasing in import cargos lately, a larger lifting capacity is recommended. Exceeding 50 tons for the current No.7 RMG (Rail Mounted Gantry crane) is better. RMG built to specifications for cold climate is available for outdoor use. A 130-ton crane is shown below for reference.



All Terrain Crane			KA-1300
Performance	Lifting Capacity	ton	130
	Boom Capacity	11.8m ton	130 x 2.5m
		19.8m ton	50 x 7.0m
		27.9m ton	35 x 9.0m
Measurements	Length	Overall mm	14,595
	Height	Incl.boom mm	4,000
	Width	Overall mm	3,000
	Total Weight	ton	90.5
Carrier	Max Speed	km/h	75
	Min Turning Radius	m	9.8
	Drive Wheel select	6 wheels	8 wheels

Lifting Load Table Operational Radius(m)	11.8m boom with heavy device	11.8m boom	19.8m boom	27.9m boom
2.5	130.0t	70.0t		
3.0	120.0t	70.0t	50.0t	
3.5	110.0t	70.0t	50.0t	
4.0	101.0t	70.0t	50.0t	35.0t
4.5	89.0t	70.0t	50.0t	35.0t
5.0	79.5t	70.0t	50.0t	35.0t
6.0	64.5t	64.5t	50.0t	35.0t
7.0	54.0t	54.0t	50.0t	35.0t
8.0	46.0t	46.0t	46.0t	35.0t
9.0	40.0t	40.0t	40.0t	35.0t
10.0			35.5t	33.7t
12.0			28.5t	27.8t

Source: Japanese Manufacturer

(2) Forklift Truck (electric)

Electric forklift trucks are used mainly for trans-loading and sorting cargo from/to closed wagons at hangar facilities. Capacity is about 1.5 tons.

Electric Forklift Truck			Standard Specification		
			FB10-7	FB15-7	FB20-7
Performance	Max Lift Capacity	kg	1,000	1,500	2,000
	Center of Gravity of Cargo	mm	500		
	Lift Height	mm	3,000		
	Speed of Ascent ：Full load/No load	mm/s	390 /580	350 /580	290 /510
	Running Speed	km/h	16	16	15
Measurements	Length	mm	2,720	2,875	3,160
	Width	mm	1,070	1,070	1,150
	Height (Head Guard)	mm	2,050	2,050	2,095
	Weight	kg	2,680	2,710	3,470
Battery	Voltage	V	48		
	Standard Capacity	AH/5H	330	400	450
	Controller		Running：AC Inverter Loading：DC Chopper		

Source: Japanese Manufacturer

(3) Forklift Truck (diesel)

Diesel forklift trucks are used mainly for trans-loading and sorting cargo from/to closed wagons indoors or outdoors. Models built to specifications for cold climate are required for outdoor use. Capacity is about 2 to 3 tons.

Diesel Forklift Truck			Standard Specification				
			*FD20C13・T13	*FD25C13・T13	FD20C3・T3	FD25C3・T3	FD30C3・T3
Performance	Max Lift Capacity	kg	2000	2500	2000	2500	3000
	Center of Gravity of Cargo	mm	500				
	Lift Height	mm	3000				
	Speed of Ascent ：No load/Full load	mm/s	670/630				590/520
	Running Speed Clutch First Gear/Second Gear	km/h	7.0/14.5		8.5/19.0		9.0/19.5
	Min Turning Radius	mm	2170	2240	2170	2240	2400
Measurements	Length	mm	3400	3625	3400	3625	3775
	Width	mm	1150				1225
	Height (Mast)	mm	1995		2030		2075
	Height (Head Guard)	mm	2070				2090
	Max Height during Working	mm	4030				4250
	Tread：Front/Rear	mm	970/970				1000/970
	Weight	kg	3340	3700	3340	3700	4390
Engine	Volume	liter	2.663				
	Output Power	kW(PS)/rpm	42.0(57.0)/2400				
	Output Torque	N・m(kgf・m)/rpm	170.0(17.3)/2300				
Tire	Frot		7.00-12-12PR				28x9-15-12PR
	Rear		6.00-9-10PR				6.50-10-10PR

Source: Japanese Manufacturer

(4) OHBC (Over Head Bridge Crane)

An OHBC is used for trans-loading and sorting containers from/to flat wagons or open wagons at hangar No. 4. One unit of the two OHBC there is not in good condition right now. Larger lifting capacity than the current OHBC (30.5 tons to 40 tons) and telescopic type spreader (20' and 40' combined) are recommended to increase efficiency. Both existing units at No. 4 should be replaced by new ones and an additional two

units should be installed for the new hangar (four sets are required in total). For reference, a longer-spanned OHBC used at the Port of Singapore (outdoor type) is shown below. By comparison, the Dostyk model has half the span and lifting height and so each speed for traveling and hoisting is enough with the half of OHBC in the table below.


OHBC (Over Head Bridge Crane)	
Rated Load	40ton
Rail Span	43.6m
Height	28m
Gantry Speed (Empty/Full load)	120/90m/min
Trolley Speed	70m/min
Hoist Speed (Empty/Full load)	130/53m/min
Powered by	6.6kv AC Supply

Source: Japanese Manufacturer

Regarding container work, containers are lashed at the four bottom corners to the wagon by steel wire for securing to prevent turning over in storm. Instead, Twist-Lock (the same fixing device as is used for vessel transportation) is recommended to securing containers.

Note:

- Twist-Lock to secure containers to wagons
- Easier to secure or release compared to steel wire
- Lock and unlock by turning a lever 90 degrees
- Weight: 9.0kg
- Sliding Type Twist Lock (weight 9.0kg)

Left Lock Type Left Lock Type Left Lock Type Right Lock Type

Source: Japanese Manufacturer

(5) Reach Stacker

This is used for trans-loading and sorting containers or heavy/bulky/long cargos from/to flat or open wagons at yard No.4A. One of the two existing units is not in good condition. A new machine with lifting capacity of 42 tons is recommended. Cold climate specification is required.

Reach Stacker				MR420/4	MR420/5
Performance	Stacking height			4tier	5tier
	Lifting Capacity	1row	kg	42,000	42,000
		2row	kg	25,000(34,000)	30,000
		3row	kg	11,000(16,000)	16,000
	Center of Gravity	1row	mm	1,990(1,690)	1,990
		2row	mm	3,840(3,740)	3,840
		3row	mm	6,340(6,180)	6,280
Measurement	Gross Weight		kg	64,000(70,000)	71,000
	Length	Folded boom	mm	10,900(11,400)	11,600
	Height	Max boom up	mm	15,250	17,600
	Width		mm	4,180	4,180
Engine	Type			Mitsubishi6D24-TL	Mitsubishi6D24-TL
	Output Power		kW/PS	198/270(243/330)	243/330
	Revolution		rpm	2,100(2,200)	2,200
	Volume		liter	11.945	11.945

Source: Japanese Manufacturer

(6) RMG (Rail Mounted Gantry Crane)

Regarding the gate type of rail crane at yard No.7, two cranes in operation are considered unnecessary for the time being since the installation is comparatively new. Moreover, down time ratio can be reduced by

establishing a maintenance organization and carrying out scheduled maintenance.When lifting heavy cargos of more than 50 tons, the above- mentioned mobile crane should be used.

10.6.3 Information and Communication System

(1) Purpose

Along with facility expansion, the necessary information and communication equipment will be upgraded.

For effective terminal work and timely provision of accurate information to the new transportation information system, a local area network will be established among yards and offices and PDAs will be equipped for operators to retrieve and input data at their workplaces.

These pieces of equipment are a part of the new freight information system. This means a new Information and Communication systems implemented at Dostyk that will provide useful information, to make terminal operations more effective and information generated at this terminal more exact and that is stored in KTZ central systems.

In addition, information on containers will be captured and distributed to related organizations.

The benefits of this are as follows:

- Field operators can be informed of works proceeding in advance,
- Completion of field work will be relayed to the control center and the next station quickly and correctly,
- Location in the terminal is captured, and
- Errors in shipping document data decrease.

As a part of total freight information systems, they make it possible to:

- Inform customers or forwarders of the location of containers or wagons.

- Notify the destination about cargo delays.

(2) Infrastructure

1) External network infrastructure

The communication network connection with the KTZ central data center is by satellite communication and fiber optic cable networks along rail tracks have been newly installed. Fiber optic cable for data exchange with China Railways will continue to be used. These communications measures are continuing to be used.

2) Local Area Network

Currently, LAN is installed in major offices and extended to some of the work areas by cables. This should be extended to newly developed working areas. As a result, all working areas in the terminals will be covered. Wireless LAN technology such as WiMAX/WiFi should be implemented for flexible operation of the network. Draft configuration of draft terminal design is shown in Figure 10.6-5.

To connect LAN, external network and equipment and network communication equipment, i.e., routers, will be installed.

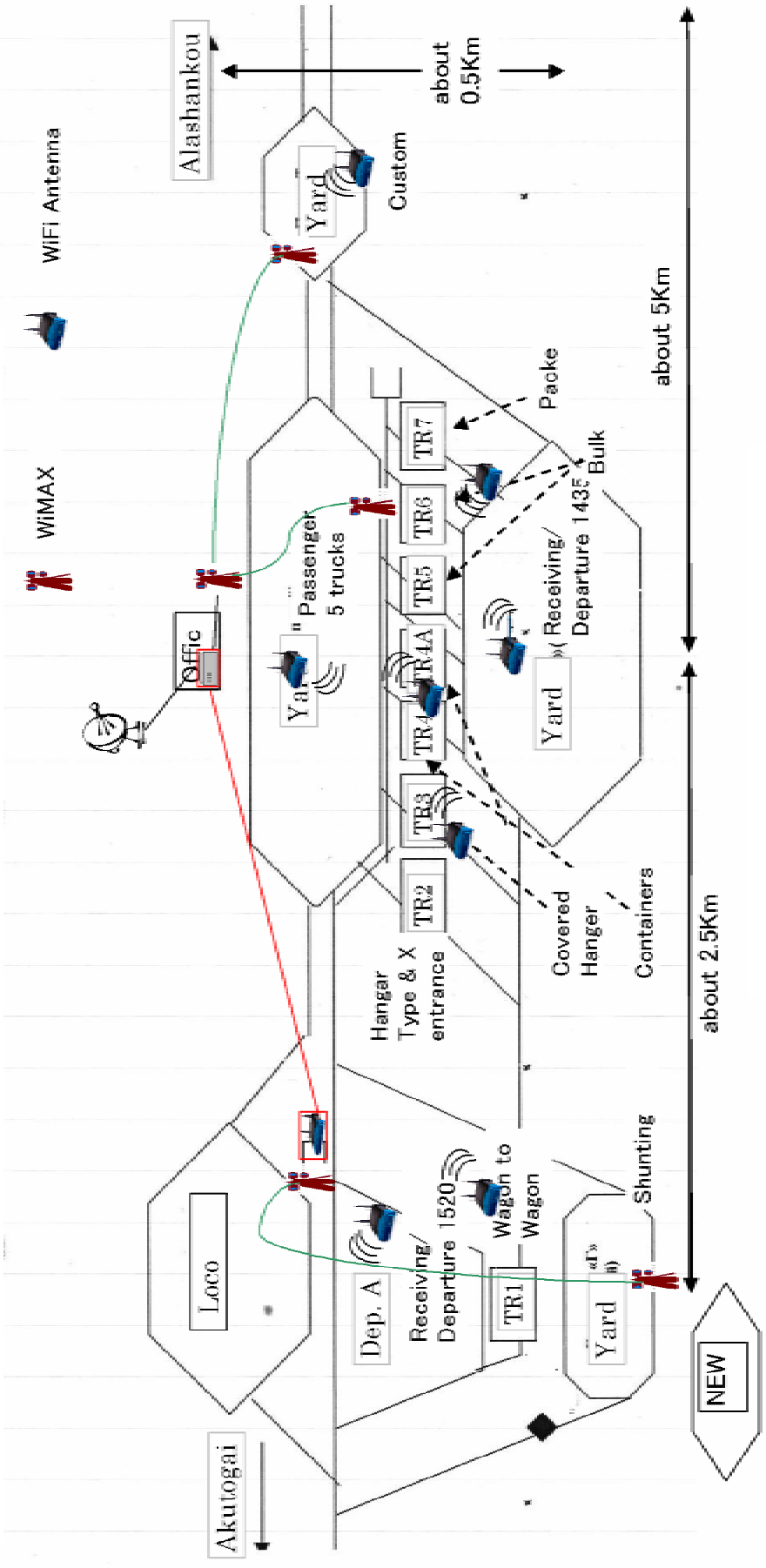


Figure 10.6-6 Network for Dostyk Stastion

3) Equipment

At this moment, more than 10 servers such as mail server, DHCP server, etc. and over 50 PCs exist and they will be used as is.

Terminal servers will be installed near the router in the administration office building as the new application system.

New PCs and printers are supposed to be installed not only in the offices but also in the major work areas. PDAs are to be distributed to operators at the yards.

PDA specifications

Manufacturer --- HP, Casio, etc.

Operating System --- Windows CE

CPU -----VR4122/150MHz

Size --- 85mm * 27.7mm* 165mm

Screen --- TFT 320 * 240 / 65,536 colors

Network Interface --- IEEE802.11b（WiFi）

(3) Application Functionality

Terminal servers will have some operation support functions which will need some software development. This can be a part of the new freight information system. Assumed functions are in Table 10.6-2.

Table 10.6-2 Assumed Application Functionality for Terminals

Terminal System	
	Shipping Document loading
	Train make-up information loading
	Train arrival/departure loading
Handy Terminal System	
	Work Order Shunting
	Work Order Loading/Unloading
	Work Order make-up
	Register work completion
Data transfer from/to ACTOM	
	Train schedule
	Train arrival/departure
	Shipping documents
Data exchange system	
	Receiving data
	Sending data

Source: JICA Study Team

(4) Equipment

Equipment is summarized in Table 10.6-3. Software will be installed at all terminals where the same software will be used by a certain rule.

Table 10.6-3 Summary

Category	Items
Hardware	Terminal Servers / PCs / Printers / WiMAX / WiFi / PDAs / Cables / Hub/Modems
Software development & installation	Development & Implementation

Source: JICA Study Team

10.7 Construction Plan, Management Plan and Cost Estimate

10.7.1 Construction Plan

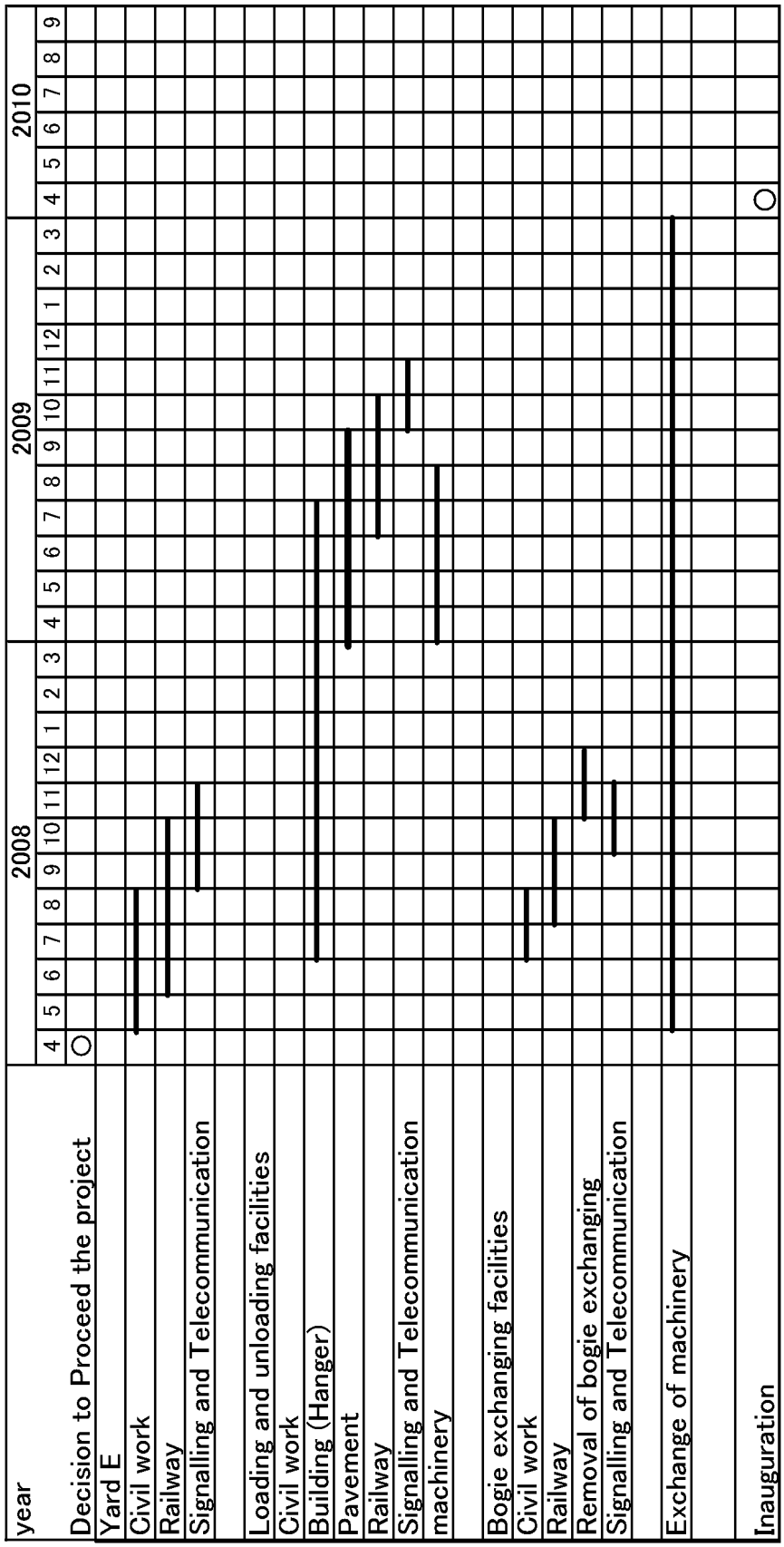
The Construction Plan is plannedto be completed within two years because of the short capacity in the near future.

It is recommended to carry out the Construction of Yard E and Reforming Bogie Interchanging Facilities within 2008.

The building of an additional Container Trans-loading Hangar is planned to be constructed by 2009.

Replacement of machinery is scheduled to be carried out during the two years of 2008 and 2009. (Table 10.7-1)

Table 10.7-1 Construction Schedule



10.7.2 Management Plan

(1) Organization Chart

Dostyk Station is situated on the border of China and the organization chart is shown in the Tables 10.7-1 to -3.

The total population of Dostyk Station including children is about 4,800 persons.

(2) Staffing Plan

The current staffing schedule of Dostyk Station is as follows:

Dostyk Station Workers (cargo service and traffic service)

Total 602 persons

Including: 305 persons in cargo service
297 persons in traffic service

JSC Kedentransservice:

450 loaders
24 crane operators
258 strappers
94 management personnel

Military guards, customs office, frontier service:

Information is secret

Locomotive fleet:

30 train drivers
30 assistant train drivers
4 instructors
8 management personnel

Track facilities:

4 line sections

Per line section: 2 track chargemen for each line section – total 8 persons
4 track foremen for each line section – total 16 persons
20 linemen for each line section – total 80 persons

6 management personnel

Signal Engineering Office:

15 mechanics

5 radio operators
10 telephone operators
8 management personnel

Wagon fleet:

68 car inspectors
10 crane operators
20 strappers
324 machinemen
5 operators of the bogie interchanging yard
5 operators of the technical inspection station

The staffing schedule at Dostyk Station with regard to the JICA Team's proposed project will be increased as follows:

Construction of yard E (narrow gauge)

Creating of another container trans-loading hangar：+26 (4 crane operators, 22 lashing workers)

Replacement of cargo handling equipment

Reforming Bogie Inerchanging Facilities

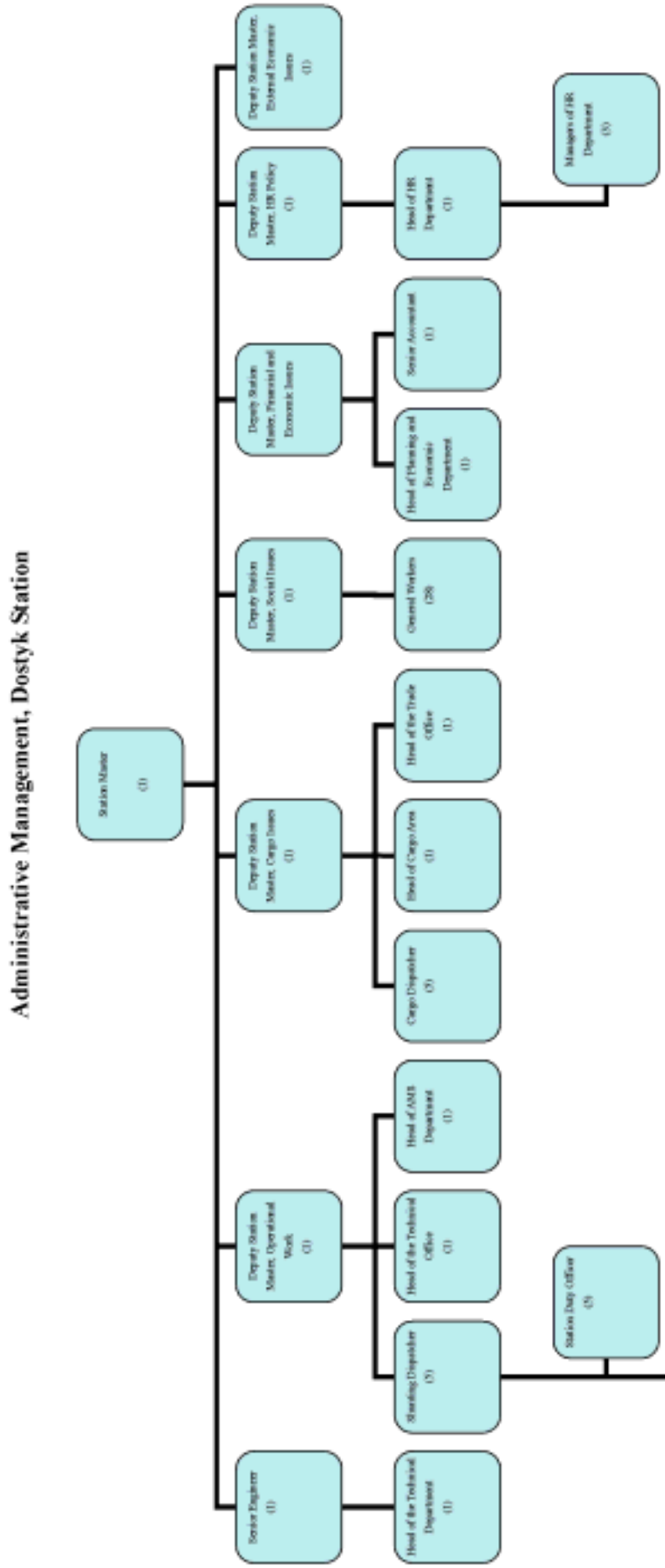


Figure 10.7-1 Administrative Management, Dostyk Station

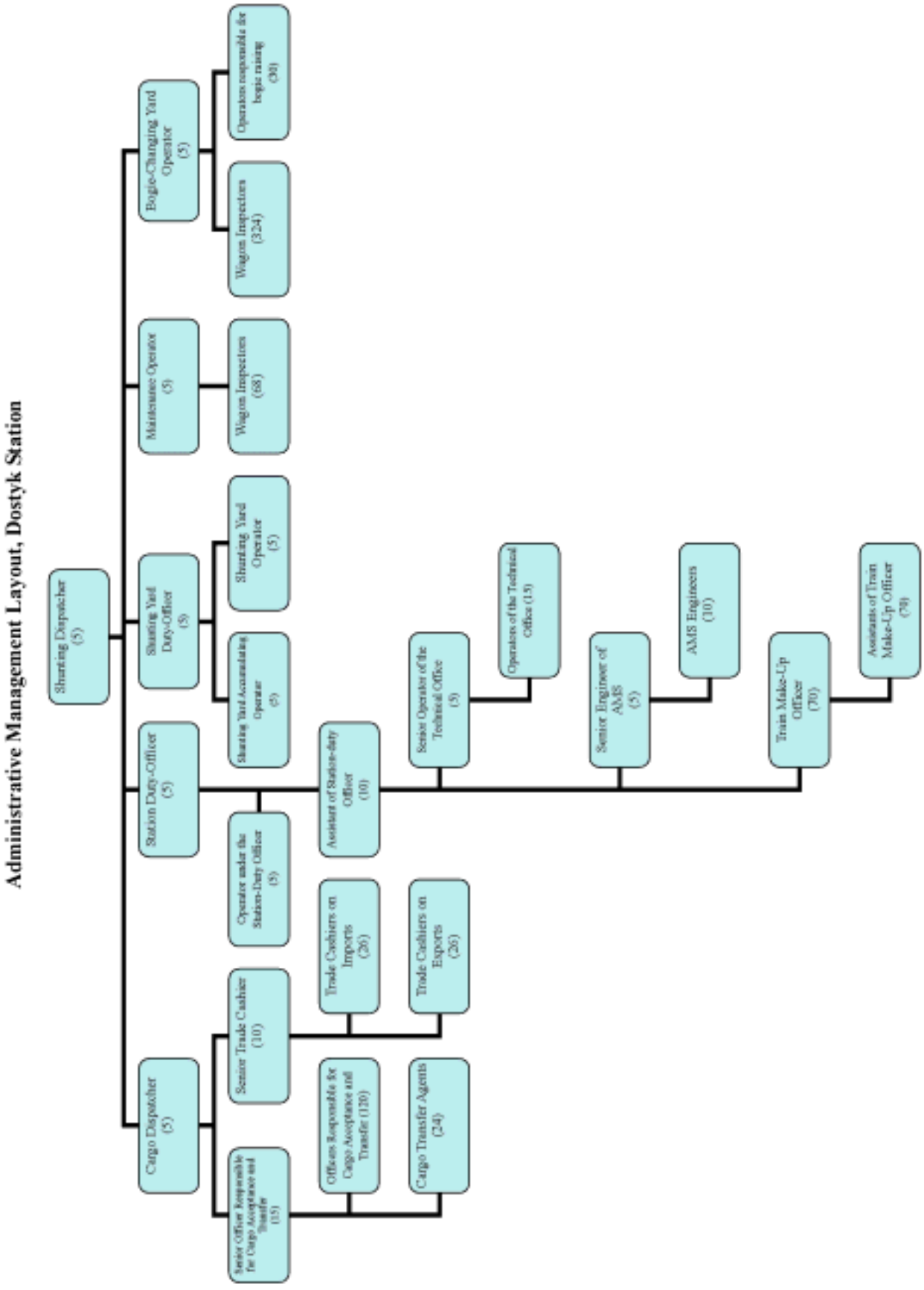


Figure 10.7-2 Administrative Management, Layout Dostyk Station

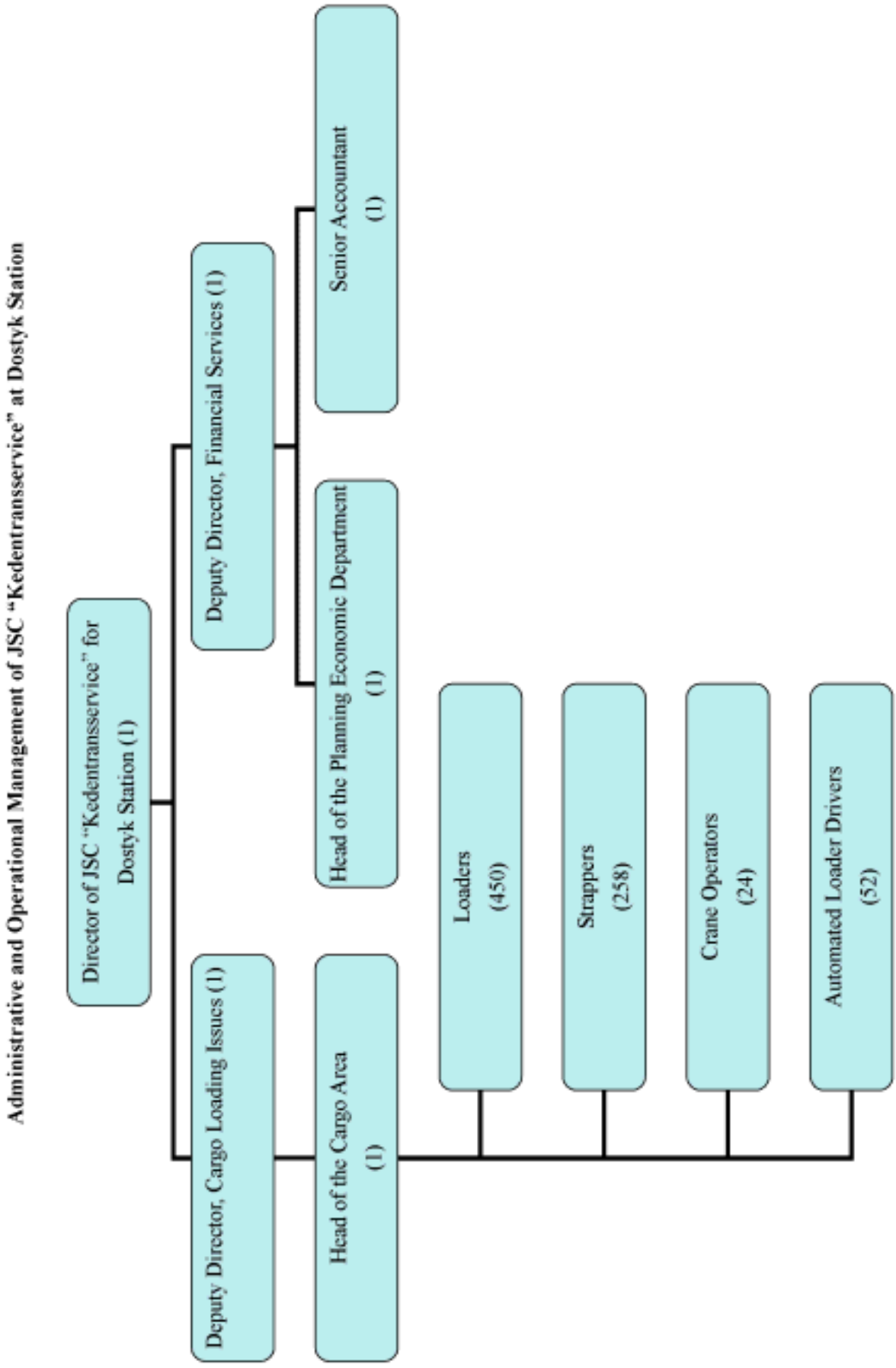


Figure 10.7-3 Administrative and Operational Management, of JSC "Kedentransservice" at Dostyk Station

(3) Recommendations

1) Provide better education or training for new, unskilled staff or younger staff

Education or training for new, unskilled staff or younger staff is important and indispensable for railway work to be carried out according to regulations and prevent accidents.

To back up the on-the-job-training at the main stations including Dostyk Station, new buildings or rooms with necessary facilities specialized in training will be necessary.

For example, preparing and revising manuals, and visually introducing operation technology and accidents occurring at Dostyk Station and the other stations will be useful.

This will assist chief engineers and the safety department to carry out efficient education or training.

Current education is carried out by the Center of Staffing Division and the following 4 subdivisions; Aktobe training center, Karaganday training center, Pavlodar training center and Taraz training center.

These training centers are in charge of education and training for railway staffs over a broad area. New buildings or rooms with necessary facilities specialized for education and training will play the role of day to day education for railway staff at the main stations and neighboring stations.

2) Simplify work procedures to inform the day to day work and clarify responsibility

The railway work is being carried out by KTZ and the companies concerned.

It is necessary to further simplify work procedures and give all concerned personnel the necessary information regarding train operation, especially changed diagrams and the content of the day to day work.

The responsibilities of the companies must be clarified as much as possible so that they can work efficiently and reliably. As well, this will be useful for avoiding accidents.

3) Simplify document inspection

Simplification of freight inspection is recommended for solving the yard D bottleneck.

Even if yard E is completed and the marshalling work is carried out efficiently, the bottleneck cannot be fixed, because of the time needed for inspection. To resolve this, simplified inspection procedures are expected to shorten inspection time.

More inspection by scanning devices is needed for more reliable and efficient inspection.

4) Maintenance system

The maintenance system is currently ineffective, so the machinery often breaks down.

It is recommended to carry out inspections and repairs at regular intervals every day, every month, every year, etc. Contents of the inspection differ in accordance with the above intervals. To increase work efficiency, it is also recommended to replace expendable parts at prescribed intervals and establish a supply system for spare parts.

10.7.3 Project Cost Estimate

(1) Quantity of each project

Quantity for each project is as follows.

1) Construction of yard E (standard gauge)

Facility items for yard E are as follows.

Total rail track: 9,100m
Roadbed: 9,100m
Switch: 23 sets
Signal device: one set

2) Construction of an additional container trans-loading hangar

An additional hangar equivalent in parallelis built on vacant land to the north of current No. 4 hangar.

Additional facility items are as follows.

Hangar (one building):	(length 358m	width 22m)	7,876 m^2
Track (broad gauge) length:			450 m
Switch:			1 set
Track (narrow gauge) length:			420 m
Switch:			1 set
Pavement:	(8X358)		2,864 m^2
OHBC (over head bridge crane)			

3) Replacement of cargo handling equipment

Equipment to be updated is shown in Table 10.7-2.

Cargo Handling Equipment in Dostyk

Location	No.	Name	Purpose	Capacity (ton)	Manufacture	Issue year	Initial cost (tenge)	Condition
No.1	1	Mobile crane KC4562	Piece cargo transloading	20	Kraz	1991	3,856,800	
	2	Crane KC-5363D	ditto	36		1992	8,779,500	
	3	Crane KC-5363D	ditto	36		1992	8,779,500	
	4	Crane KC-5363A	ditto	25				
	5	Crane KC-45721	ditto	20				
	6	Crane KC-45721	ditto	20				
	7	Crane KC-3563	ditto	16	Kamaz			
No.2	1	Electric Loader (Forklift track)	Piece cargo transloading	1.5		1998	1,810,200	Broken: not in operation since 2002
	2	ditto	ditto	1.5		1998	1,810,200	ditto
	3	ditto	ditto	1.5		1998	1,810,200	ditto
	4	ditto	ditto	1.5		1998	1,810,200	ditto
	5	ditto	ditto	1.5		1998	1,810,200	ditto
	6	ditto	ditto	1.5		1994	1,810,200	ditto
	7	ditto	ditto	1.5		1994	1,810,200	ditto
	8	ditto	ditto	1.5		1994	1,810,200	ditto
	9	Diesel Loader (Forklift track)	ditto	1.5-3.0	Toyota			
	10	ditto	ditto	1.5-3.0	Toyota			
	11	ditto	ditto	1.5-3.0	Toyota			
	12	ditto	ditto	1.5-3.0	Toyota			
	13	ditto	ditto	1.5-3.0	Toyota			
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	2	ditto	ditto	1.5-3.0	Toyota			
	3	ditto	ditto	1.5-3.0	Toyota			
	4	ditto	ditto	1.5-3.0	Toyota			
	5	ditto	ditto	1.5-3.0	Toyota			
	6	ditto	ditto	1.5-3.0	Toyota			
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No.4a	1	Reach Stacker	Container and heavy cargo	41	SISU	1997	10,030,400	Broken: not in operation
	2	Reach Stacker	Container and heavy cargo	45	SMV	2003	12,300,000	
No.7	1	Rail Mounted Gantry Crane	Heavy cargo	50		2005	32,000,000	
	2	Rail Mounted Gantry Crane	Heavy cargo	30		2006	28,000,000	

*All equipment has purchased as secondhand.

Table 10.7-2 Cargo Handling Equipment at Dostyk Terminal

Source: KTZ Dostyk Station

4) Reforming of Bogie Interchanging facilities

Description of facilities to be extended to the west are as follows.

Total rail construction: 300 m

Switch: 4 sets

Shifting jacks required for 2 wagons

5) Conceptual plans for the new Dostyk Container Station

The main contents of the plan for trans-loading containers on platforms or open wagons from standard track to wide track or vice versa are as follows:

Two sheds: each one about 900m in length and 27m in width with two different-gauge tracks and platforms about 12m in width

Two sheds: $2 \times 900 \times 27 = 48{,}600\ m^2$

Platforms in the sheds: $2 \times 900 \times 12 = 21{,}600\ m^2$

Wide gauge track: $2 \times 400 + 2 \times 900 = 2{,}600$ m

Narrow gauge track: $(1400+900) + 2 \times 900 = 4{,}100$ m

4 Open platforms: $4 \text{ lane} \times 20{,}000\ m^2 = 80{,}000\ m^2$

Three 1,520-mm gauge tracks for arrival and departure of trains

3 x 1100 = 3,300 m

One 1,520-mm gauge drill track: 1,100 m

Turnouts: 8 sets

Single 1,435-mm gauge track from current Dostyk Station to Dostyk New Container Station 6,000 m

Three 1,435-mm gauge tracks for arrival and departure of trains

3 x 1,100 = 3,300 m

-One 1,435-mm gauge drill track: 1,100 m

-Turnouts: 7 sets

-Signal and telecommunication: 1 set

-Container center: 2F, 20m x 60m x 2 =2,400 m^2

- Access road: 6,000 m

Overhead cranes with 50-ton capacity 4

(2) Project Cost

The project cost is as follows.

Table 10.7-3 Cost Table for Dostyk (Phase 1) (Excluding equipment cost)

E Yard				
Item	Unit	Quantity	Unit cost(KZT)	Cost (KZT)
Rail track	m	9,100	12,600	114,660,000
Roadbed	m	9,100	5,000	45,500,000
Switches	set	23	4,185,000	96,255,000
Signal and telecom.	set	1	70,000,000	70,000,000
Subtotal				326,415,000
Additional container trans-loading hangar				
Item	Unit	Quantity	Unit cost(KZT)	Cost (KZT)
Hangar building	m2	7,876	56,500	444,994,000
Track (Broad gauge)	m	92	12,600	1,159,200
Track in the shed	m	358	45,000	16,110,000
Switch	set	1	4,185,000	4,185,000
Track (narrow gauge)	m	62	12,600	781,200
Track in the shed		358	45,000	16,110,000
Switch	set	1	4,185,000	4,185,000
Pavement	m2	2,864	20,000	57,280,000
Subtotal				544,804,400
Bogie Interchanging facility				
Item	Unit	Quantity	Unit cost(KZT)	Cost (KZT)
Rail	m	300	12,600	3,780,000
Switches	set	4	4,185,000	16,740,000
Shifting jack removal	set	2	25,000	50,000
Subtotal				20,570,000
Total				891,789,400

Information and Communication System

Category	Items	Cost (KZT)
Hardware	Terminal Servers, PCs, PDAs, etc.	22,800,000
Software development and installation	Development and Implementation	86,400,000
Total		109,200,000

Table 10.7-4 New Dostyk Container Station (Phase 2)

Name	Unit	Quantity	Unit cost(KZT)	Cost (KZT)
Two sheds	m2	48,600	56,500	2,745,900,000
Platform in the shed	m2	21,600	20,000	432,000,000
Rail in the shed	m	1,800	45,000	81,000,000
Rail out of the shed	m	800	12,600	10,080,000
Rail in the shed	m	1,800	45,000	81,000,000
Rail out of the shed	m	2,300	12,600	28,980,000
4 Open plat form	m2	80,000	20,000	1,600,000,000
3 Tracks (Broad)	m	3,300	12,600	41,580,000
1 Drill track (Broad)	m	1,100	12,600	13,860,000
Switches	set	8	4,185,000	33,480,000
Track from Dostyk St.	m	6,000	12,600	75,600,000
3 tracks (Narrow)	m	3,300	12,600	41,580,000
1 Drill track (Narrow)	m	1,100	12,600	13,860,000
Switches	set	7	4,185,000	29,295,000
Signai. And Telecom.	set	1	200,000,000	200,000,000
Center building	m2	2,400	154,000	369,600,000
Access road	m	6,000	100,000	600,000,000
Total				6,397,815,000

Table 10.7-5 Cost table for equipment (Dostyk) **(KZT)**

Name	model	capacity	required uni	unit price(tg)	ammount(tg)	location	life span	annual maintenance cost(tg)
Mobile crane	KA-1300	130t	1	150,000,000	150,000,000	No.1	15 years	2,000,000
Fork lift(electric)	FB15-7	1.5t	8	2,000,000	16,000,000	No.2, No.3	10 years	200,000
Fork lift(diesel)	FD25C3	2.5t	4	2,000,000	8,000,000	No.1	15 years	300,000
OHBC		40t	4	200,000,000	800,000,000	No.4	15 years	4,000,000
Reach stacker	MR420/4	42t	2	60,000,000	120,000,000	No.4a	15 years	3,000,000
Total					**1,094,000,000**			**9,500,000**

Twist-lock	N-3TL			3,500		install for Flat Wagon	10 years	

Table 10.7-6 Cost table for equipment (New Dostyk Container Station) **(KZT)**

Name	model	capacity	required uni	unit price(tg)	ammount(tg)	location	life span	annual maintenance cost(tg)
OHBC		50t	4	200,000,000	800,000,000		15 years	4,000,000
Total					**800,000,000**			**4,000,000**

10.8 Environmental and Social Considerations

10.8.1 Legal Framework Related to Environmental and Social Considerations

(1) Policies Related to Environmental and Social Considerations of Kazakhstan

The environmental protection policy of the Kazakhstan administration has been executed aiming at achieving "National development that harmonizes with the environment" shown in "Kazakhstan 2030," the national basic plan.

The "Basic philosophy concerning Kazakhstan's environmental security in 2004-2015," a medium-term environmental strategy, was announced officially as Executive Order (No.1241) in December, 2003.

The program "Environment protection of the Republic of Kazakhstan for 2005-2007" was approved by the decree of the Government in December 2004 (No. 1278).

(2) Laws Related to Environmental and Social Considerations

Recently Kazakhstan developed and adopted several important legislative documents aiming at the enhancement of ecological safety and the social aspects.

In the beginning of 2007, the Ecological Code of Kazakhstan was adopted. It is a comprehensive law related to environmental conservation and protection. It includes the contents of various previous laws and the old "Law on Protection of the Environment" as well.

The contents are as follows.

Section 1: General Provisions

Section 2: Licensing of Activity in the Field of Environmental Protection, Ecological Normalization, Technical Regulation in the Field of Environmental Protection, Assessment of Influence on Environment, Ecological Examination, Ecological Sanctions and Ecological Audit

Section 3: Economic Regulation related to Protection of Environment and Natural Management

Section 4: Ecological Control

Section 6: Zones of Extreme Ecological Situation and Ecological Disaster

Section 7: Ecological Education and Enlightenment, Scientific Research and International Cooperation in the Field of Environmental Protection

Section 8: Ecological Requirements for Achieving Economic and Other Activity

Section 9: Responsibility for Ecological Lawbreaking and Sanctions for Ecological Disputes

Environmental standards are shown in Chapter 4, Section 2 of the Ecological Code of Kazakhstan.

Kazakhstan has ratified about 25 international conventions including those on climate change, destruction of the ozone layer, desertification and preservation of biodiversity.

(3) Mechanism and Procedure of the Environmental Impact Assessment

The Environmental Impact Assessment is showed in Chapter 6, Section 2 of the Ecological Code of Kazakhstan.

According to the law, EIA is carried out by the implementing organization of the project with public hearings during the progress of the project planning.

The Environmental Protection Division in each oblast handles permission procedures for environmental assessment in Kazakhstan. The executing organization submits the document to the Environmental Protection Division in the oblast and follows the procedure. The permission procedure of environmental assessment takes four months or less. The period of the investigations is not included in this. The survey organization which obtained special authorization executes the investigation.

(4) Environmental Administration Operation

The Ministry of Environmental Protection works chiefly for environmental protection, environmental impact assessment, environmental measures, etc.

The Ministry's main duties are the following.

- ・Plan environmental protection policy
- ・Monitor and supervise environmental protection standards for industrial agencies
- ・Decide improvement and management programs in the environmental protection field
- ・Examine economical techniques for environmental protection
- ・Participate in international cooperation for environmental protection
- ・Spread environmental education and maintain environmental protection information

10.8.2 Present Environmental Condition of the Project Site

(1) Present Social Environment

1) Resettlement inhabitants

There is a village around Dostyk Station. However, the Dostyk project site is on the present railway site and there are no dwellings there.

2) Economic activity

Most residents in the village around Dostyk Station are staff related to the railway and the border administration including patrols. Therefore, there is no noteworthy economic activity. But pasturage is run on the vast, flat ground around the station.

3) Traffic/public facilities

The railway runs in the direction of the southeast to China and the northwest to Kazakhstan from Dostyk Station. The major road runs parallel to this railway.

4) Community division

There is no community on the project site.

5) Cultural property

There are no residents on the project site. There is no historical cultural heritage around Dostyk Station.

6) Water use rights and common use rights

The subject area is mostly under the management of Almaty oblast Akimat.

7) Waste

Construction wastes are disposed of at the disposing site of Almaty oblast management.

(2) Present Condition of Natural Environment

1) Topography and soil conditions

The project site is located in a large valley between mountains to the northeast and southwest. It is almost flat.

The soil stratum of the ground surface is mainly gravel, so water penetration is high and stability is also high.

2) Soil erosion

This region is arid. Moreover, the open lands around the project site are mostly pasture. The soil surface is exposed and grass is scattered. Therefore, it is not in a condition in which soil degradation becomes a new problem.

3) Hydrological regime

No rivers are seen around the project site and Dostyk Station. Water flows underground in the center of the large valley.

4) Fauna and flora

There is a Nature Reserve designated by the country on the northwest side. Other than this, there are no preservation areas. The surroundings of the project site are dry pasture. Therefore, there are no important habitats for flora or fauna around the project site.

5) Meteorology

Change in temperature are large in both summer and winter. The average amount of precipitation is 200mm or less a year and there is a few average amount of precipitation in the east part of Kazakhstan. There are many months when the maximum wind velocity exceeds 40m/s. The prevailing wind direction is southeast.

6) Landscape

The project is located on the railway site and the landscape with the railway facilities surrounds it. There is a residential area around the station. The other landscape is smooth open ground.

(3) Present Conditions for Pollution

1) Air pollution

There are almost no artificial influencing factors in the atmosphere around the project site. Dust flies up according when vehicles go by. However, winds are strong and the ground is dry and bare. Therefore, it is thought that the influence of artificial dust is must smaller than that of dust naturally generated.

2) Water pollution

The residential area around Dostyk Station has a sewage system. Drainage is disposed of at a point about 3 km from the village.

3) Noise and vibration

There is automobile and railway traffic as a factor generating noise and vibration. However, as there is little traffic of either cars or trains, this does not influence the environment around the project site.

4) Land subsidence

The soil is composed of alluvial fan deposits including much gravel around the project site. As the ground is stable, occurrence of subsidence is not a concern.

10.8.3 Comparison of Alternatives

Alternatives of the project plans were examined for impact on the environment (Table 10.8-1).
The characteristics of the plans are as follows.

Case1: Improvement in the railway site around Dostyk Station
(*q.v.* 10.6.1(1)-(4))

Case2: Improvement in the railway site around Dostyk Station and establishment of new logistics facilities along the railway at about 9km to the west from Dostyk Station
(*q.v.* 10.6.1(5))

Table10.8-1 Environmental Impact Items

Environmental items			Contents	Alternatives		Note
				Case1	Case2	
Social environment	1	Resettlement inhabitants	Resettlement accompanying site possession (transfer of right of residence and land ownership right)			In both cases, no dwellings exist in and around the project sites
	2	Economic activity	Loss of land or other production opportunities, change in economic structure			
	3	Traffic/public facilities	Impact on traffic congestion, accidents, and other transportation conditions and impact on schools, hospital, etc.			
	4	Community division	Division in the local community due to traffic obstructions			
	5	Cultural property	Loss of shrines or temples/buried cultural property, etc. and their depreciation in value.			
	6	Water use rights and common use rights of common	Obstruction of fishing rights, water use rights, common use rights for mountains and forests			
	7	Public health conditions	Deterioration of health environment due to production of waste and harmful insects			
	8	Waste	Production of construction waste, waste dumps, solid waste, etc.	△	△	More soil disposal in Case 2 than Case 1.
	9	Hazards	Increase of landslide danger, cave-ins, accidents			
Natural environment	1	Topography and soil conditions	Alteration of valuable topography and soil condition by excavating and embanking			
	2	Soil erosion	Topsoil corrosion due to rain and following land reclamation or forest clear cut			
	3	Groundwater	Pollution due to water shortage and water extracted by excessive pumping			
	4	Hydrological regime	Change in riverbed and flow volume due to land reclamation or drainage flow			
	5	Coastal zone	Change in coastal fauna and flora and coastal corrosion due to changing ocean conditions			
	6	Fauna and flora	Extinction of species and breeding obstruction due to changing habitat condition			
	7	Meteorology	Change in temperature and wind condition due to large-scale reclamation and buildings			
	8	Landscape	Topographical change due to land reclamation and obstruction of harmony due to presence of structure		△	In Case 2, new buildings appear on flat ground.
Pollution	1	Air pollution	Pollution due to harmful gases, exhaust from vehicles and plants	△	△	
	2	Water pollution	Pollution due to inflow of sand, plant drainage, etc			
	3	Soil contamination	Contamination due to outflow and dispersion of drainage and harmful substances.	△	△	
	4	Noise and vibration	Noise and vibration caused by operation of vehicles, train yard, etc.	△	△	

	5	Land subsidence	Subsidence of land surface accompanying changes in topography or a drop of ground water level			
	6	Offensive odor	Exhaust gas and offensive odors			
○：There is an impact (comparatively large). △：There is an impact (comparatively small).						

Source: JICA Study Team, based on Screening Format, JICA 1994.

Table 10.8-1 shows the result of comparing environmental impacts of the alternatives on the project site.
Although Case 2 carries out a new operation, there are no major environmental impacts because there are vast open plains and no dwellings around the project area. Moreover, there are no natural protection areas, cultural heritage areas, etc.
However, Case 2 affects the landscape because new buildings are built and increases surplus soil.
No new influence on the environment occurs if the project is not executed. However, from the viewpoint of the economic activity, it is more advantageous to execute the product than not to proceed.
Generally, the environmental impacts of Case 1 are smaller than those of Case 2, because Case 1 covers only improvement of the current facilities.
As a result, Case 1 was adopted.

10.8.4 Scoping

Scoping on the environmental impacts of the project (the Case 1) has been carried out. The evaluation items have been extracted (Table 10.8-2). Moreover, the reasons for extraction and examination were prepared. "Waste", "Air pollution", "Soil contamination" and "Noise vibration" are extracted as items whose influences should be considered. Other items are not objects of the evaluation.

Table 10.8-2(1) Scoping of Environmental and Social Considerations

Environmental items			Grade	Note
Social environment	1	Resettlement inhabitants	D	The project site is located on the railway site and there is no village on the project site. Therefore, the question of resettlement inhabitants does not arise.
	2	Economic activity	D	The improvement of Dostyk Terminal will activate the economy in the surrounding area.
	3	Traffic/public facilities	D	The project site is located on the railway site and the project is an improvement of current facilities. Therefore, there are few factors that would newly influence existing traffic and public facilities.
	4	Community division	D	The project site is located on the railway site. Therefore, no community division is caused.
	5	Cultural property	D	There is no cultural heritage around Dostyk Station.
	6	Water use rights and common use rights	D	The project site is located on the railway site and no problems of water use rights and common rights arise.
	7	Public health conditions	D	This project does not influence sanitation.
	8	Waste	B	Little waste is generated due to construction. However, facility construction will generate surplus soil. Therefore, a few negative influences are assumed.
	9	Hazard	D	As the geographical features are smooth, it is assumed that no landslide disasters will occur. As the wind in Dostyk is strong; wind measurement needs to be taken into consideration in the facility plan. However, there are no dwellings around the project site. Therefore, there is no influence on the environment.

Source: JICA Study Team, based on Scoping Format, JICA 1994.

Table 10.8-2(2) Scoping of Environmental and Social Considerations

Environmental items			Grade	Note
Natural environment	1	Topography and soil conditions	D	The project site is located on the railway site. Therefore, there are no worthy geographical or geological features. As hard soil strata are visible in the vicinity of the ground's surface, water penetration is high and soil stability is also high. Therefore, it is considered that there are few influences on geographical and geological features.
	2	Soil erosion	D	This region is arid. Moreover, there is pasture land. The soil surface is exposed and grass is scattered. Therefore, executing the project will not cause new soil erosion problems.
	3	Groundwater	D	In the present facility plan, there is no factor influencing groundwater.
	4	Hydrological regime	D	There are no rivers around the project site. No river was observed in the center of the large valley around Dostyk Station, either. Water is flowing underground. There is no factor influencing the flow of water in the present facility plan.
	5	Coastal zone	D	There is no coast or sea around the project site. Therefore, the project has no influence on this.
	6	Fauna and flora	D	There is a nature reserve designated by the country to the northwest. No preservation areas exist around Dostyk Station except for this nature reserve. Besides this, the land is dry pasture. Therefore, there are no special habitats for flora and fauna. The project site is located on the railway site and the project does not have a new influence on flora and fauna.
	7	Meteorology	D	Based on the contents of the project, it is considered that the project will not especially influence the weather. However, the wind in the Dostyk area is strong.
	8	Landscape	D	Station facilities buildings already exist at Dostyk Station. Moreover, the project site is located on the railway site. Therefore, it is considered that there will be little additional influence on the landscape even if new facilities are built.

Source: JICA Study Team, based on Scoping Format, JICA 1994.

Table 10.8-2(3) Scoping of Environmental and Social Considerations

Environmental items			Grade	Note
Pollution	1	Air pollution	B	Minor negative influence is assumed as the number of construction vehicles will increase.
	2	Water pollution	D	The planned facilities do not have a major influence on water quality. Wastewater from the railway site is drained through wastewater treatment facilities at present. The project site is located on the railway site. Therefore, the project will not cause new water pollution. Little muddy water will be generated due to digging during construction, because the groundwater level is deeper than the depth of digging. Moreover, there is sewage in Dostyk and sewerage is processed in a treatment facility located about 3km from the town.
	3	Soil contamination	B	Facility construction will generate surplus soil. Therefore, some negative influence is assumed.
	4	Noise and vibration	B	Some negative influence is assumed as the number of construction vehicles increases.
	5	Land subsidence	D	As the hard soil strata are visible near the earth's surface, water penetration is high and soil stability is also high. Therefore, land subsidence is not likely to occur.
	6	Offensive odor	D	The project site is located on the railway site and the project is an improvement of the current facilities. Therefore, there is little new influence due to offensive odor.
Comprehensive evaluation				Judging from the characteristics of the planned facilities, no elements that have a serious negative influence on the natural and social environment have been found. Waste, air pollution, noise, vibration and soil contamination are items requiring consideration, although their impact is likely to be minor.
Explanation of grading A: An important negative impact is expected. B: A minor negative impact is expected. C: Impact is uncertain at the present stage. D: No further examination required.				

Source: JICA Study Team, based on Scoping Format, JICA 1994.

The Environmental Protection Agency in each oblast handles the environmental assessment permission procedure in Kazakhstan. The executing organization submits the document to the Environmental Protection Agency in the oblast and follows the procedure. Dostyk is under the jurisdiction of the Environmental Protection Agency in Taldykurgan, Almaty Oblast. The permission procedure for environmental assessment takes four months or less. The period of the investigation is not included in this. The survey organization that obtained special authorization executes the investigation.

10.8.5 Initial Environmental Examination (IEE)

(1) Forecast and Evaluation

In Scoping, the environmental items requiring examination have been extracted. The influence levels of these items were arranged as follows.

Table 10.8-3(1) Results of Forecast and Evaluation

Environmental items	Forecast and Evaluation
Waste	Spread foundation is planned for the foundation of the buildings. Surplus soil will be generated with digging. Little construction and demolition waste will be generated. Surplus soil will be disposed off and managed in a waste disposal site under the management of Almaty Oblast Akimat. Some negative influences are assumed from the generation of surplus soil as mentioned above. However, as a spread foundation is planned, the amount of surplus soil generated due to facility construction is not large. It is a controllable amount.
Air pollution	It is assumed that materials flow of containers and freight by rail traffic will increase along with the project, but there will be no increase in trucking. As vehicle traffic will not increase, the project will have little impact on air quality. Construction vehicles will increase around the project site under construction. However, dwellings are limited to one block northeast of Dostyk Station. The residents are persons related to the railway and border administration including patrols and it is assumed that there are no general residents. Negative influences may occur as construction vehicles increase. However, those influences are minor, judging from the situation of the surroundings. Moreover, appropriately setting the route for construction can decrease those influences.

Source: JICA Study Team

Table 10.8-3(2) Results of Forecast and Evaluation

Environmental items	Forecast and Evaluation
Soil contamination	As a spread foundation is planned, the surplus soil generated with the facilities construction is not large. It is a controllable amount. Surplus soil will be disposed off and managed in a waste disposal site under the management of Almaty Oblast Akimat. The surplus soils are generated from the railway site and so there is little possibility that the soil is contaminated. Minor negative influence is assumed from the generation of surplus soil. However, soil contamination is not a major problem.
Noise and vibration	It is assumed that the materials flow of containers and freight by rail traffic will increase along with the project. Construction vehicles will increase around the project site under construction. However, dwellings are limited to one block northeast of Dostyk Station. The residents are persons related to the railway and border administration including patrols and it is assumed that there are no general residents. Negative influences may occur as rail traffic and construction vehicles increase. However, those influences are minor, judging from the surrounding situation. Moreover, appropriately setting the route for construction can decrease those influences.

Source: JICA Study Team

As a secondary influence, there is a possibility that automobile traffic may increase because the volume of distribution at Dostyk Station increases.

(2) Integrated evaluation

Judging from the characteristics of the planned facilities, no elements with a serious negative influence on the natural and social environment are found.

Waste, air pollution, noise, vibration, and soil contamination are items requiring consideration. The influence due to construction is temporary and not major. We can reduce the influence by drawing up an appropriate construction execution plan.

10.8.6 Environmental Management Plan: Monitoring and Amelioration

(1) Amelioration Process

The project site is located on railway land. The surroundings of the project site are pastures and open ground.

Therefore, it is considered that there is little influence on the residents.
The items considered are the followings.
An appropriate disposal method is required for the surplus soil.
Furthermore, it is expected that setting the construction vehicle route appropriately will decrease the environmental impact of air pollution, noise and vibration.

(2) Monitoring Plan

When EIA is executed in accordance with the procedure in Kazakhstan, the implementing organization will execute the monitoring according to the ecological code of Kazakhstan Republic.
It is hoped that monitoring will be executed for the items shown in the above-mentioned environmental improvement plan. It is recommended to confirm the disposal plan of surplus soil and the operation plan of construction vehicles.

10.8.7 Conclusion and Recommendation

Judging from the characteristics of the planned facilities, no elements with a serious negative influence on the natural and social environment have been found.
Construction will have some influences, but it will be temporary and minor. It is recommended to examine the construction method and decrease the environmental impacts.
An appropriate execution plan for construction can reduce negative impact.

10.9 Economic and Financial Analysis

10.9.1 Economic Analysis

(1) Objective and Methodology of Analysis

The objective of the economic analysis is to analyze and evaluate the viability of implementing this project from the viewpoint of the national economy in Kazakhstan.
A comparative analysis of the investment costs and benefits in cases of both executing the project ("With the project") and not executing the project ("Without the project") is carried out.
Economic Internal Rate of Return (EIRR), Benefit and Cost Ratio (B/C Ratio) and Net Present Value (NPV) are used as the evaluation indexes. The evaluation criteria are described as follows.

(2) Economic Internal Rate of Return (EIRR)

The EIRR is a discount rate which makes the investment costs and benefits calculated in the net present value equal. It is calculated by the following formula.

$$\sum_{t=0}^{n} \frac{(Bt - Ct)}{(1 + EIRR)^{t}} = 0$$

Where n : The period for the analysis (first year t = 0)
Bt : The benefit for each year
Ct : The difference of investment cost and operation cost between "With the project" and "Without the project" in each year

(3) Benefit and Cost Ratio (B/C Ratio)

B/C is a ratio derived from the net present value of the benefit divided by the net present value of the cost. The merit of the project is evaluated based on the value of this ratio. If this ratio is higher than 1.00 under the designated discount rate, this project is considered socially and economically viable. The social discount rate to be applied for the evaluation of B/C Ratio is normally decided by the opportunity cost in the country concerned. For this project, the social discount rate applied is 12%, referring to those of the International Bank for Reconstruction and Development (IBRD) and Asian Development Bank (ADB).

(4) Net Present Value (NPV)

Net present value is the total of project benefits minus costs annually discounted by the social discount rate.

(5) Premises

In this study, the analysis is carried out based on the following premises.

1) Price

In general, all costs are classified into tradable group (imported products) and nontradable group (domestic products and personnel expenses). To estimate the economic price, all transfer items such as taxes, duties and subsidies shall be deducted from the viewpoint of the national economy.

The economic prices for the imported products are used as CIF (Cost, Insurance and Freight) prices, which represent border prices without import duties, plus inland transportation costs and other fees. The custom tariff rates of import goods are from 0 to 30%.

On the other hand, those of the domestic products are estimated by deducting Value Added Tax (VAT) and other taxes from their market prices. To calculate economic prices, VAT 14% is adjusted from each market price.

Similarly, the economic prices of the personnel expenses are estimated by deducting personal income tax. In this study, the taxes born by income taxpayers are assumed as 10%.

As to Standard Conversion Factor (SCF) to convert the domestic price to the boarder price level, SCF between 0.95 and 1.00 has been applied previous studies on infrastructure projects in Kazakhstan. Consequently, the SCF for this analysis is assumed 1.00.

All the prices used in the analysis are based on the year 2007.

2) Exchange Rate

The exchange rates used in the study are assumed to be KZT120.23 to USD1.00 and JPY120.73 to USD1.00 as a mean value of May 2007.

3) Inflation

Since it is difficult to estimate the inflation rate during the whole period of the project, it is not considered in the analysis. All figures are based on constant prices in the year 2007.

4) Project Life for the Analysis

The period of the analysis is set for 32 years including the construction period from April 2008 to March 2010 is and 30 years' operation from April 2010 to March 2040. In the analysis, each project year is considered to begin in April and end next March.

5) Useful Lives of the Assets

As for the life cycle of facilities with proper maintenance, following durations are presumed shown in Table 10.9-1. All facilities invested in the project will be considered as new assets.

Table 10.9-1 Useful Lives of Assets

Item	New Assets	Revalued Assets
Buildings and constructions	20-45	12-18
Rail track infrastructure:		
Land improvement	80	43-51
Railway tracks and infrastructure	20-45	10-26
Engineering constructions, pipelines	20-45	14-18
Cable, electrical and telecommunication networks	10-25	9-13
Transport, machinery, equipment and other:		
Wagons, cisterns, railcars and snow-blowers	18-32	7-10
Locomotives	15-36	12
Regular major of locomotives	7	7
Machine tools, cranes and tractors	15-35	6-13
Transportation equipment	10-15	7-12
Office furniture and equipment	5-15	4-6

Source: Consolidated Financial Statements 2005 by KTZ

6) Residual Value

The residual value at the last year of the project will be counted as the negative investment cost. The residual value will be calculated based on the useful lives.

(6) Case of Analysis

In the analysis, the cost and the benefit are defined as the difference between the "With the project" and the "Without the project" cases. The cases are defined as follows:

1) "With the project" case

It is the case of which the proposed logistic terminal facilities are implemented in Dostyk and the transshipment is transacted with them.

2) "Without the project" case

The proposed terminal facilities are not implemented and the transshipment is transacted with the existing facilities. Alternative logistic facilities are not constructed. In this case, the overflowed transshipment volume should be dealt with another logistic facilities other than in Dostyk.

(7) Investment Costs

1) "With the project" case

The total investment costs for the logistic facilities are summarized in Table 10.9-2.

Table 10.9-2 Investment Cost (Economic Price)

Unit: million KZT

Item	2008		2009		Total		
	F/C	L/C	F/C	L/C	F/C	L/C	F/C+L/C
E Yard							
Rail track	61.813	30.174	0.000	0.000	61.813	30.174	91.987
Roadbed	0.000	39.912	0.000	0.000	0.000	39.912	39.912
Switch	59.304	16.887	0.000	0.000	59.304	16.887	76.191
Signal and telecommunication system	37.737	18.421	0.000	0.000	37.737	18.421	56.158
Sub Total	**158.854**	**105.394**	**0.000**	**0.000**	**158.854**	**105.394**	**264.248**
Additional Container Transloading Hanger							
Hanger building	0.000	195.173	0.000	195.173	0.000	390.346	390.346
Track (broad gauge)	0.000	0.000	0.625	0.305	0.625	0.305	0.930
Track in the shed	0.000	0.000	8.685	4.239	8.685	4.239	12.924
Switch	0.000	0.000	2.578	0.734	2.578	0.734	3.313
Track (narrow gauge)	0.000	0.000	0.421	0.206	0.421	0.206	0.627
Track in the shed	0.000	0.000	8.685	4.239	8.685	4.239	12.924
Switch	0.000	0.000	2.578	0.734	2.578	0.734	3.313
Pavement	0.000	0.000	0.000	50.246	0.000	50.246	50.246
Sub Total	**0.000**	**195.173**	**23.573**	**255.876**	**23.573**	**451.049**	**474.622**
Bogie Interchanging Facility							
Rail	2.038	0.995	0.000	0.000	2.038	0.995	3.033
Switch	10.314	2.937	0.000	0.000	10.314	2.937	13.251
Shifting jacks removal	0.000	0.044	0.000	0.000	0.000	0.044	0.044
Sub Total	**12.352**	**3.975**	**0.000**	**0.000**	**12.352**	**3.975**	**16.327**
Transport Equipment							
Mobile crane	0.000	0.000	115.521	0.000	115.521	0.000	115.521
Fork lift (electric)	12.322	0.000	0.000	0.000	12.322	0.000	12.322
Fork lift (diesel)	6.161	0.000	0.000	0.000	6.161	0.000	6.161
OHBC	616.114	0.000	0.000	0.000	616.114	0.000	616.114
Reach stacker	92.417	0.000	0.000	0.000	92.417	0.000	92.417
Sub Total	**727.015**	**0.000**	**115.521**	**0.000**	**842.537**	**0.000**	**842.537**
Information and Communication System							
Information and communication system	0.000	0.000	84.100	0.000	84.100	0.000	84.100
Total	**898.221**	**304.542**	**223.194**	**255.876**	**1,121.415**	**560.419**	**1,681.833**

Note: The cost of land acquisition is not required for the project.
Source: JICA Study Team

2) "Without the project" case

No alternative terminal facilities are constructed in the area.

(8) Operation Costs

1) "With the project" case

As data on the operation costs of the existing logistics terminal are not available, they are estimated based on the average monthly salary and other expenses described in the staffing plan in Chapter 10.7. According to the "Consolidated Financial Statements" of the national company, KTZ JSC, that includes financial results of all KTZ's subsidiaries, the ratio between personnel costs to the other expenses was found to be 25 to 75 in 2005. As to average monthly salaries after deducting income tax, KZT72,000 and 144,000 per month are applied for workers and managers, respectively.

The annual operation costs including maintenance cost of cargo handling equipment are summarized in Table 10.9-3.

Table 10.9-3 Annual Operation Costs ("With the project" case)

(Unit: million KZT)

Year	Annual Operation Costs
2010	827
2012	1,401
2017 and after	2,639

Source: JICA Study Team

2) "Without the project" case

In this case, no additional operation and maintenance costs are required.

(9) Economic Benefits

The economic benefits of this project are considered to be as follows.

1) The benefit of Transport/Transaction Time Saving (TTS) for freight transport
2) The benefit of Vehicle Operating Cost (VOC) Saving for freight transport
3) Investment and maintenance costs saving
4) Other indirect benefits

As it is difficult to quantify the transport/transaction time saving (TTS), this benefit should not be counted in the analysis. Similarly, other indirect benefits cannot be quantified, but they are useful for deciding the implementation of the project.

(10) Vehicle Operating Cost Saving

If the project is not implemented, the freight volumes overflowing the existing transshipment capacity in Dostyk have to be transported by truck. Here, the benefit of vehicle operating cost saving is a value of the effect of either decrease or increase of the same transportation service cost by this project, in comparison with that of the "Without the project" case.

Measurement method

C^0-C^1

C^0: Total transport cost in "Without the project" case

C^1: Total transport cost if this project is executed

1) VOC of "With the project" case

In the "With the project" case, no vehicle operating cost (VOC) for trucks will be required.

2) VOC of "Without the project" case

In the "Without the project" case, the VOC of trucks is still required. Though data on the VOC of trucks are not available, the VOC by truck would cost about 2.5 times as much as transport cost by rail according to a previous study ("Transport and Trade Facilitation Issues in the CIS7, Kazakhstan and Turkmenistan" by the World Bank in 2003). Consequently, the unit transport cost by rail and the VOC are assumed to be KZT1.25/ton-km and KZT3.12/ton-km, respectively, referring to the consolidated financial statements of KTZ. The average transport distance of the rail freight was 748.3km on average, according to the results between 2001 and 2005 in the Statistical Yearbook of Kazakhstan 2006. 50% of the VOC saving are counted in the analysis. The annual VOC savings benefits are summarized in Table 10.9-4 and the incremental transshipment volume by the project is illustrated in Figure 10.9-1.

Table 10.9-4 Annual VOC Saving Benefit

Item	2010	2012	2017 and after
Incremental Transshipment Volume by the Project (million ton)	2.106	3.903	9.126
Ton-kilometer Converted to Rail (million ton-km)	1,576	2,920	6,829
VOC Saving Benefit (million KZT)	1,476	2,736	6,397

Source: JICA Study Team

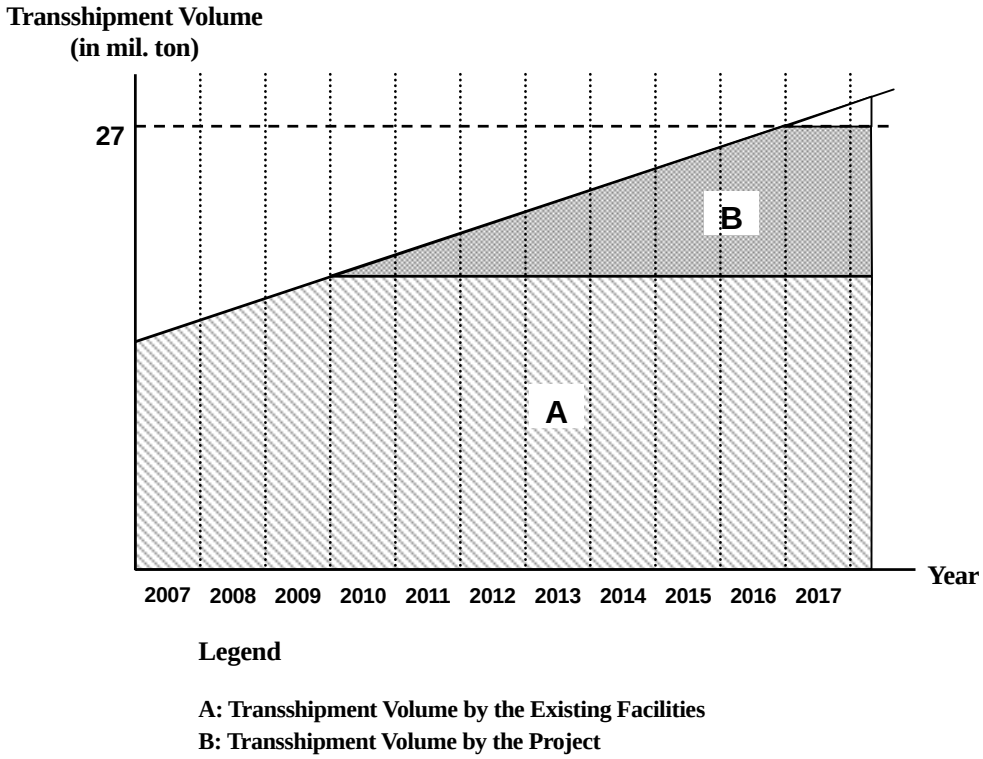

Figure 10.9-1 Incremental Transshipment Volume by the Project

(11) Maintenance Cost Saving

If the project is not be implemented, maintenance costs for the existing highways would be required to deal with the non-converted freight traffic by truck. Reduction of those maintenance costs will become an economic benefit.

According to data from the MTC, the annual maintenance cost for republican highways has been estimated at KZT22.1 billion for the year 2007. On the other hand, the total road transport ton kilometer according to the Statistical Yearbook 2006 was 47.1 billion ton-kilometers. Comparing the total road transportation and the transportation converted to railway, maintenance costs saving can be obtained. The effective ratio of the maintenance costs by the road transport is assumed at 50% of the total costs. The results are shown in Table 10.9-5.

Table 10.9-5 Investment and Maintenance Costs Saving

Item	2010	2012	2017 and after
Ton-Kilometer Converted to Rail (million ton-km)	1,576	2,920	6,829
Maintenance Cost Saving (million KZT)	818	1,392	2,631

(12) Indirect Benefit

In this analysis, other indirect benefits will be found in addition to the benefits mentioned above. As it is difficult to evaluate these benefits quantitatively, the value in the figure is not shown. However, it is considered an important factor for the decision of adopting this project.

The outline of these benefits is as follows:

1) Improvement of natural and social environment

By executing this project, conversion of freight traffic volume from railway to trucks can be avoided to some extent. The non-converted freight traffic reduces exhaust emissions from trucks in addition to reducing traffic congestion and accidents.

Reducing exhaust emissions from trucks will contribute to the improvement of the global environment through reduction of greenhouse gases in addition to the improvement of the living environment in Kazakhstan. In this study, no calculation of the reduction volume of CO_2 has been carried out.

2) Improvement of regional freight transport

The development of freight market in Kazakhstan is progressing rapidly in conjunction with the nation's economic growth. The insufficient freight transaction facilities in the area cause a lot of difficulty for the freight industry. The introduction of the logistics terminal will become one of the solutions for freight transport in Kazakhstan.

3) Rationalization of transshipments

The construction of the logistics terminal will promote the containerization of freight, in particular transit freight. The containerization will contribute to the rationalization of transshipments, reduction of transaction time and the development of logistics in the region.

4) Promotion of related industries

From the production and sale of materials and equipment ordered in relation to the implementation of the project, the development of related industries and an increase in employment opportunity can be expected. The freight industry will be also promoted by the improvement of freight facilities.

5) Effect of technology transfer

Through this project, the newest freight handling technologies will be introduced. The transfer of the technologies for the freight industry in Kazakhstan is highly expected.

(13) Result of Analysis

The results of the analysis based on the above conditions are summarized in Table 10.9-6 and Table A10.9-1 in the Appendix10-1. As all the evaluation values are found excellent, this project is considered economically viable.

Table 10.9-6 Results of Economic Analysis

Discount rate = 12 %

B/C ratio	Net Present Value (million KZT)	Economic Internal Rate of Return (EIRR)
2.53	19,762	70.01 %

(14) Sensitivity Analysis

The operation and maintenance cost and the benefits applied to this analysis include certain variations. Some margin is assumed for such variable factors and by finding the variation of the result due to the margin, the stability of the project feasibility can be assured.

As the result shown in Table 10.9-7, even in the case of a +10% increase of the investment cost and O&M costs and a -10% decrease in economic benefits, the value of EIRR exceeds 12%, which is the criterion for the evaluation of the investment chance and cost considered by the various international organizations. It is, therefore, confirmed that this project is extremely sound from the standpoint of the national economy.

Table 10.9-7 Result of Sensitivity Study for Economic Analysis

Investment cost and O&M cost / Benefit	-10%	-5%	0%	+5%	+10%
+10%	84.00%	80.13%	76.52%	73.16%	70.01%
+5%	80.66%	76.85%	73.31%	70.01%	66.91%
0%	77.22%	73.49%	70.01%	66.76%	63.71%
-5%	73.68%	70.01%	66.59%	63.40%	60.40%
-10%	70.01%	66.41%	63.06%	59.92%	56.97%

10.9.2 Financial Analysis

(1) Objective of Analysis

The objective of the financial analysis is to evaluate to what extent this project has profitability and whether sound operation under various financing plans is feasible or not.

(2) Methodology of Analysis

As the evaluation indexes of the project, the Financial Internal Rate of Return on the Project (Project FIRR), FIRR on the Equity (Equity FIRR) and Financial Net Present Value (FNPV) are calculated to judge the viability of carrying out a commercial undertaking.

1) Project FIRR

The Project FIRR is the discount rate which makes the total of the investment costs and the expenditures equal to the revenues in net present value and which is calculated using the following formula.

$$\sum_{t=0}^{n} \frac{(Bt - Ct)}{(1 + FIRR)^{t}} = 0$$

Where:

N : the period for the analysis (first year t = 0)

Bt : the revenue in each year

Ct : the investment cost and the expenditure (maintenance and operation costs) in each year

2) Equity FIRR

The FIRR on the equity is calculated in the same manner of that on the project calculation using the cash flow in which the loan income, interest and repayment are included. This indeed shows the anticipated return amount for the investment fund or investors.

3) Financial Net Present Value (FNPV)

The financial net present value is the total of annual net cash flow arising from the project discounted by the WACC (Weighted Average Cost of Capital).

(3) Premises

This analysis is carried out under the following premises.

1) Price

The price for domestic products is the market price including various taxes and for imported products is the CIF price with customs duties, inland transportation cost and others.

2) Exchange rate

The exchange rates used in the study are assumed to be KZT120.23 to USD1.00 and JPY120.73 to USD1.00 as a mean value in May 2007.

3) Inflation

Since it is difficult to estimate the inflation rate during the whole period of the project, it is not taken into consideration in the analysis. All figures are based on constant prices in the year 2007.

4) Project life for the analysis

The period of the analysis is set for 32 years including the construction period from April 2008 to March

2010 and 30 years operation from April 2010 to March 2040. In the analysis, each project year is considered to begin in April and end the following March.

5) Useful lives of the assets

Regarding the life cycle of facilities with proper maintenance, the useful lives shown in Table 10.9-1 of 10.9.1 Economic Analysis are presumed. All facilities constructed in the project will be considered new assets.

6) Depreciation and residual value

The depreciation is calculated on a straight-line basis over the estimated useful lives of the assets. The residual value in the last year of the project is counted as the negative investment cost.

7) Interest during construction

The interest during construction is not taken into consideration.

8) Taxation System

Tax legislation of the Republic of Kazakhstan consists of the Tax Code and Normative Legal Acts. The Tax Code establishes the Kazakhstan taxes, levies and general tax principles. The main taxes are shown in Table 10.9-8.

Table 10.9-8 Summary of Tax Rates

Tax	Tax Rate in 2004
Corporate Income Tax (CIT)	30%
Value Added Tax (VAT)	14%
Personal Income Tax (PIT)	5-20%
Social Tax	20-7%
Pension Fund Contribution	10%
Import Duty	0-30% (weighted average rate = 13.9%*)

Note: * is based on material from the Central Asia Regional Economic Cooperation (CAREC) meeting in 2006.

Source: Kazakhstan. A business and investment guide, 2006

In this analysis, personal income tax, fixed asset tax and payroll tax are considered to be included in the O&M costs. For import duty, the tariff rate of imported goods for the project is considered a weighted average rate of 13.9%.

(4) Financing Plan

1) Financing sources

The use of international loans, government funds/equity and loans from commercial banks are considered as financing sources for the project. The conditions of each financing source are summarized in Table 10.9-9.

Table 10.9-9 Financing Sources

No.	Source	Terms of Financing	
1	Government Funds/Equity	Source:	Government fund or investor
		Ratio of fund-raising:	25% of the project cost based on the previous projects
		Dividend:	10% from the 6th year after the inauguration*1
2	Domestic Loans (in KZT)	Source:	Commercial banks in Kazakhstan
		Ratio of fund-raising:	Up to 75% of the project cost*1
		Interest rate:	18.2%*2
		Repayment terms:	Equal payment principle 10 years*1
3	Foreign Loans (in USD)	Source:	Foreign export credit agencies
		Ratio of fund-raising:	Up to 75% of the project cost*1
		Interest rate:	5.51%*2
		Repayment terms:	Equal payment principle 10 years*1
4	ODA Loan (in JPY)	Source:	Japan Bank for International Cooperation (JBIC)
		Ratio of fund-raising:	Up to 85% of the project cost (75% for the previous projects)
		Interest rate:	3.00%*2
		Repayment terms:	Equal payment principle 25 years with a grace period of 7 years

Note: *1 is an assumption for the analysis.
*2 is based on the weighted average effective interest rate by KTZ Consolidated Financial Statements on December 2005.

2) Proposed financing plan and WACC

The financing plans for each case are proposed as shown in Table 10.9-10 to 10.9-12. The weighted average cost of capital (WACC) has been calculated in real terms for each financial component. The WACC serves as a proxy to assess the financial viability of the project.

Table 10.9-10 Proposed Financing Plan 1

		Financing Component		
		Domestic Loans	Government Funds/Equity	Total
A	Weighting of financing component	75.00%	25.00%	100.00%
B	Nominal cost	18.20%	10.00%	
C	Tax rate	30.00%	0.00%	
D	Tax-adjusted nominal cost			
	[B x (1 - C)]	12.74%	10.00%	
E	Inflation rate*	7.60%	7.60%	
F	Real cost [(1 + D) / (1 + E) - 1]	4.78%	2.23%	
G	Weighted component of WACC	3.58%	0.56%	4.14%
WACC (in real terms)		**4.14%**		

Note: * shows the CPI in December 2005 from National Bank of Kazakhstan.

Table 10.9-11 Proposed Financing Plan 2

		Financing Component		
		Foreign Loan	Government Funds/Equity	Total
A	Weighting of financing component	75.00%	25.00%	100.00%
B	Nominal cost	5.51%	10.00%	
C	Tax rate	30.00%	0.00%	
D	Tax-adjusted nominal cost			
	[B x (1 - C)]	3.86%	10.00%	
E	Inflation rate*		7.60%	
F	Real cost [(1 + D) / (1 + E) - 1]	3.86%	2.23%	
G	Weighted component of WACC	2.89%	0.56%	3.45%
WACC (in real terms)		**3.45%**		

Note: * shows the CPI in December 2005 from National Bank of Kazakhstan.

Table 10.9-12 Proposed Financing Plan 3

		Financing Component		
		ODA Loan	Government Funds/Equity	Total
A	Weighting of financing component	75.00%	25.00%	100.00%
B	Nominal cost	3.00%	10.00%	
C	Tax rate	30.00%	0.00%	
D	Tax-adjusted nominal cost			
	[B x (1 - C)]	2.10%	10.00%	
E	Inflation rate*		7.60%	
F	Real cost [(1 + D) / (1 + E) - 1]	2.10%	2.23%	
G	Weighted component of WACC	1.57%	0.56%	2.13%
WACC (in real terms)		**2.13%**		

Note: * shows the CPI in December 2005 from National Bank of Kazakhstan.

(5) Investment Cost

The initial investment costs are summarized in Table 10.9-13.

Table 10.9-13 Investment Cost (Market Price)

Unit: million KZT

Item	2008		2009		Total		
	F/C	L/C	F/C	L/C	F/C	L/C	F/C+L/C
E Yard							
Rail track	80.262	34.398	0.000	0.000	80.262	34.398	114.660
Roadbed	0.000	45.500	0.000	0.000	0.000	45.500	45.500
Switch	77.004	19.251	0.000	0.000	77.004	19.251	96.255
Signal and telecommunication system	49.000	21.000	0.000	0.000	49.000	21.000	70.000
Sub Total	**206.266**	**120.149**	**0.000**	**0.000**	**206.266**	**120.149**	**326.415**
Additional Container Transloading Hanger							
Hanger building	0.000	222.497	0.000	222.497	0.000	444.994	444.994
Track (broad gauge)	0.000	0.000	0.811	0.348	0.811	0.348	1.159
Track in the shed	0.000	0.000	11.277	4.833	11.277	4.833	16.110
Switch	0.000	0.000	3.348	0.837	3.348	0.837	4.185
Track (narrow gauge)	0.000	0.000	0.547	0.234	0.547	0.234	0.781
Track in the shed	0.000	0.000	11.277	4.833	11.277	4.833	16.110
Switch	0.000	0.000	3.348	0.837	3.348	0.837	4.185
Pavement	0.000	0.000	0.000	57.280	0.000	57.280	57.280
Sub Total	**0.000**	**222.497**	**30.608**	**291.699**	**30.608**	**514.196**	**544.804**
Bogie Interchanging Facility							
Rail	2.646	1.134	0.000	0.000	2.646	1.134	3.780
Switch	13.392	3.348	0.000	0.000	13.392	3.348	16.740
Shifting jacks removal	0.000	0.050	0.000	0.000	0.000	0.050	0.050
Sub Total	**16.038**	**4.532**	**0.000**	**0.000**	**16.038**	**4.532**	**20.570**
Transport Equipment							
Mobile crane	0.000	0.000	150.000	0.000	150.000	0.000	150.000
Fork lift (electric)	16.000	0.000	0.000	0.000	16.000	0.000	16.000
Fork lift (diesel)	8.000	0.000	0.000	0.000	8.000	0.000	8.000
OHBC	800.000	0.000	0.000	0.000	800.000	0.000	800.000
Reach stacker	120.000	0.000	0.000	0.000	120.000	0.000	120.000
Sub Total	**944.000**	**0.000**	**150.000**	**0.000**	**1,094.000**	**0.000**	**1,094.000**
Information and Communication System							
Information and communication system	0.000	0.000	109.200	0.000	109.200	0.000	109.200
Total	**1,166.304**	**347.178**	**289.808**	**291.699**	**1,456.112**	**638.877**	**2,094.989**

Note: The cost of land acquisition is not required for the project.
Source: JICA Study Team

(6) Revenue

The operation revenue consists of transshipment charges for containerized freight and non-containerized freight. It is calculated by multiplying the transshipment volume by the average transshipment charge.

1) Freight demand

According to "Freight Traffic Demand Forecast" in Chapter 10.4, the incremental freight demand due to the project is summarized in Table 10.9-14.

Table 10.9-14 Incremental Freight Demand

(Unit: million ton)

Year	Freight Demand		
	To China	To Kazakhstan	Total
2010	1.159	0.947	2.106
2012	2.071	1.832	3.903
2017 and after	4.362	4.764	9.126

Source: JICA Study Team

2) Tariff revenue

a) Transshipment charge

The transshipment charge is estimated referring to the international transit tariff (ITT) and common tariff (CT) according to Kazakhstan tariff policy for 2007 freight year shown in Table 10.9-15.

Considering the shares for containerized freight and non-containerized freight, the unified weighted average transshipment charge is assumed as KZT1,000 per ton for the analysis.

Table 10.9-15 Transshipment Charge

(Unit: KZT/ton)

Item	International Transit Tariff (ITT)	Common Tariff (CT)
Transported in open-top wagon	1,100	1,000
Transported in boxcars	1,450	1,000
Palleted cargo	1,150	1,200
Packed cargo	1,300	1,200
Fluid cargo, transported in tanks	1,100	800
Large Container loaded	6,800	6,800
Large Container empty	3,400	3,400

Source: Kazakhstan Tariff Policy for 2007 Freight Year

b) Total revenues

As the transshipment is conducted in both Dostyk and Mt. Ala in China, revenues from transshipment in Dostyk are counted in the analysis. The estimated revenues based on the above conditions are summarized in Table 10.9-16.

Table 10.9-16 Revenues

(Unit: million KZT)

Year	Transshipment Charge
2010	947
2012	1,832
2017 and after	4,764

Source: JICA Study Team

(7) Expenditure

1) Operation costs

As data on the operation costs of the existing logistics terminal is not available, this is estimated based on the average monthly salary and other expenses in the staffing plan, Chapter 10.7. According to the "Consolidated Financial Statements" of the national company, KTZ JSC, that includes financial results of all KTZ's subsidiaries, the ratio between personnel costs to other expenses was found to be 25 to 75 in 2005. As to the average monthly salaries, KZT80,000 and 160,000 per month are applied for workers and managers, respectively.

The annual operation costs including maintenance cost of cargo handing equipment are summarized in Table 10.9-17.

Table 10.9-17 Annual Operation Costs

(Unit: million KZT)

Year	Annual Operation Costs
2010	900
2012	1,525
2017 and after	2,872

Source: JICA Study Team

(8) Result of Analysis

1) FIRR

As the result of calculations in each plan, the indexes of financial evaluation (FNPV, Project FIRR, Equity FIRR) and cash flows are summarized as shown in Tables 10.9-18 and Appendix 10-2, respectively. Detailed financial statements are presented in Appendix 10-3.

Table 10.9-18 Index of Financial Analysis

Financing Plan	FNPV (million KZT)	Project FIRR (%)	Equity FIRR (%)	WACC (%)
1	13,288	23.49	28.05	4.14
2	13,140	23.10	33.85	3.45
3	13,197	23.12	43.26	2.13

As the result of the analysis based on the above conditions, the Project FIRRs in Financing Plans 1 to 3 are found to be 23.49%, 23.10% and 23.12%, respectively. Under the assumption applied, the projects under all financing plans are considered financially viable, because the Project FIRRs are higher than each WACC. The Equity FIRRs in Financing Plans 1 to 3 are financially sound. In addition, there are no significant differences among the financing plans. This project will be attractive to investors.

(9) Sensitivity Analysis

In the above analysis, there are still uncertainty factors in the adopted elements (investment cost, revenues and expenditures). In order to identify the financial stability of the project, the sensitivity analyses were conducted in Financing Plans 1 to 3 to observe the variation of the result by assuming fluctuations of each value in accordance with each uncertainty. The results were found financially viable.

The result of all sensitivity analyses shown in Tables 10.9-19 to 10.9-21 means that the Project FIRRs in the case of the investment cost and expenditure increase by 10% and a revenue decrease by -10% can satisfy the WACC. Each financing plan for this project will be very stable to the fluctuation of investment cost and revenue.

Table 10.9-19 Result of Sensitivity Analysis on Financing Plan 1

Investment cost & Expenditure / Revenue	-10%	-5%	0%	+5%	+10%
+10%	24.74%	24.74%	24.74%	24.74%	24.74%
+5%	24.13%	24.13%	24.13%	24.13%	24.13%
0%	23.49%	23.49%	23.49%	23.49%	23.49%
-5%	22.83%	22.83%	22.83%	22.83%	22.83%
-10%	22.15%	22.15%	22.15%	22.15%	22.15%

Table 10.9-20 Result of Sensitivity Analysis on Financing Plan 2

Investment cost & Expenditure / Revenue	-10%	-5%	0%	+5%	+10%
+10%	24.34%	24.34%	24.34%	24.34%	24.34%
+5%	23.73%	23.73%	23.73%	23.73%	23.73%
0%	23.10%	23.10%	23.10%	23.10%	23.10%
-5%	22.45%	22.45%	22.45%	22.45%	22.45%
-10%	21.78%	21.78%	21.78%	21.78%	21.78%

Table 10.9-21 Result of Sensitivity Analysis on Financing Plan 3

Investment cost & Expenditure / Revenue	-10%	-5%	0%	+5%	+10%
+10%	24.34%	24.34%	24.34%	24.34%	24.34%
+5%	23.74%	23.74%	23.74%	23.74%	23.74%
0%	23.12%	23.12%	23.12%	23.12%	23.12%
-5%	22.47%	22.47%	22.47%	22.47%	22.47%
-10%	21.80%	21.80%	21.80%	21.80%	21.80%

10.10 Conclusion

To meet future freight traffic increases, the bottlenecks have to be remedied. For this purpose, several projects for improvement of Dostyk Station have been prepared.

Under the assumption applied, the projects are economically and financially viable.

As to the social environmental effects, taking into consideration the characteristics of the planned facilities, no elements that exert serious, negative influence are found. Some influences are generated due to construction, and they are temporary and negligible. Those influences can be reduced by the appropriate planning of construction methods.

The planned projects must be carried out soon to match the increase in freight cargo.

To make the projects more useful after completion, our recommendations are as follows.

(1) Improve education or training for new, unskilled staff or younger staff

Education or training for new, unskilled staff or younger staff is important and indispensable for the railway work to be carried out according to regulations and to prevent accidents.

To back up on-the-job-training at the main stations including Dostyk Station, a new building or rooms with necessary facilities especially for training will be necessary. For example, preparing and revising manuals and visually introducing he operation technology and accidents that occurred at Dostyk Station and other stations will be useful.

(2) Simplifying Work Procedures to Inform the Day to Day Work and Clarify Responsibility

The railway work is being carried out by KTZ and related companies. The responsibilities of the companies should be made as clear as possible to ensure efficient and reliable operations. This is also useful for avoiding accidents.

(3) Simplifying Document Inspection

A simplified inspection procedure is expected to shorten the inspection time.

Inspection by scanning devices should be used, for more reliable and efficient inspection.

(4) Maintenance System

The current maintenance system is inadequate and the machinery often breaks down.

It is recommended to carry out inspection and repair at regular intervals every day, every month, every year, etc. Contents of the inspection differ based on the above intervals. To increase work efficiency, it is also recommended to replace expendable parts at prescribed intervals and establish a supply system for spare parts.