SECTION C

ECONOMIC AND FINANCIAL ANALYSIS

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ECONOMIC AND FINANCIAL ANALYSIS

CHAPTER 1 FINANCIAL AND ECONOMIC SITUATIONS

1.1 PRESENT CONDITIONS OF KAZAKHSTAN

1.1.1 Economic Structure

In the age of USSR, economies of the component Republics were highly integrated to the Soviet production system and planned by Moscow. In pursuit of economic efficiency for the Soviet Union, only a few kinds of industries were developed in each Republics. Kazakhstan mainly specialized in agriculture, and metallurgy and mineral extraction. It had virtually no manufacturing industries and depended on the Soviet system.

After the break-up of the Soviet Union followed by the economic turbulence through radical system transition, Kazakhstan has not yet started from the mono-cultural economy and still highly depends on the Russian economy.

In 1997, the top exporting commodities are fuel/oil products - most of them is crude oil- (32.7% of the total exports), ferrous metals (14.8%) and copper and copper products (10.5%). The share of exporting to Russia is 42.0% and that to the total CIS countries amounts to 53.8%. The top importing commodities are reactors/machinery (16.4% of the total imports), fuel/oil products - most of them is gasoline - (14.3%), electrical equipment (7.8%) and vehicles (6.1%). The share of importing from Russia is 46.0% and that from the total CIS countries amounts to 54.0%. See Tables 1.1.1 to 1.1.4.

1.1.2 Recent Economic Situations

1) Recent GDP Growth

According to the Kazakhstan Economic Trends, the real GDP growth rate is -2.5% in 1998 while previous two years presented positive figures, 0.5% in 1996, 2.0% in 1997. This growth trend reverse was caused mainly by the Russian Ruble crisis and the decline of agricultural production. See Figure 1.1.1.

The grain harvest has come in at 7.33 million tons, its lowest level in 40 years, which is 48% below the government's target and 41% below on previous year. This is basically due to drought but it is further deteriorated by the financial crisis.

Fuel industry production slowed down to 1.7% growth in 1998 from 16.2% in 1996 and 11.4% in 1997. The total industry showed -3.5% in 1998. The producer price of oil extraction was declining in 1998 (-5.1% on previous year), especially in September (-8.8% on previous month). See Tables 1.1.5 and 1.1.6.

2) Balance of Payments

Current accounts have been showing deficits and it has been increasing, as USD 518.3 million in 1995, USD 749.9 million in 1996, USD 912.3 million in 1997 and USD 689 million in 9 months of 1998. See Table 1.1.7.

Those deficits had been covered by the surplus of capital accounts especially by Foreign Direct Investment (FDI). But overall balance shows deficit from the first quarter of 1998 as a result of FDI decline. This is because of the world-wide trend of "flight to quality" sentiment in capital markets since the Asian financial crisis. See Tables 1.1.8 and 1.1.9.

3) State Budget

The state budge deficit resulted in about 3.7% of GDP, which is the same level in 1997 and well below the 5.5% target agreed with IMF for 1998 budget. In order to attain the target, 1998 budget was very tight one as Education budget reduced by 70%, Health care by 26.8%, Agriculture by 43.6% and Mining/manufacturing by 67.9% in nominal terms.

On the other hand, VAT and Customs revenue were increased by 37.5% and 22.1% respectively due to the improvement of tax administration while Corporate income tax and Personal income tax were decreased by 4.7% and 27.5% respectively due to the economic deterioration. In addition, the government sold the state stake for the exploitation of the Caspian shelf which amounts to USD 500 million. See Tables 1.1.10 and 1.1.11.

1.2 PRESENT CONDITIONS OF ALMATY CITY

1.2.1 Impacts of New Capital City

In October 1997 the capital city of Kazakhstan moved to Astana City (formerly called as Akmola City). The population of Astana City is 271,000 as of January 1998 or about 26% of Almaty City. The territory is 300 km^2 or about 1.28 times larger than Almaty City.

It is very difficult to evaluate the impacts with the change of the capital city on the economic or financial activity in Almaty City since no quantitative data is officially announced including the budget for the development of the new city, etc. But it would not be true that money which has been invested in the new capital city would be spent for the development of Almaty City if it were still the capital city, because such money was prepared only for the construction of the new capital city.

Presently almost all Ministries of the Republic Government have moved to the new capital city but the Central Bank is still located in Almaty City as well as a number of private companies. It is expected that as New York City to Washington D.C., Sydney to Canberra, Sao Paulo to Brasilia, Almaty city will continue to be the economic center to Astana City as the administrative/political center of the Kazakhstan. Thus, the impacts on the Almaty city will be limited from the viewpoint of economy or finance at least in the next decade.

1.2.2 Household Income

1) Income Growth

Household monetary income in Almaty City is KZT 5,368.9 in 1997 per person per month and KZT 5,656.8 in 1998 at current price. When it is reviewed in real term, it increased by 10.7% in 1997 but decreased by 4.8% in 1998. This income decline is larger than those in 1995 (-1.6%) and 1996 (-3.1%) Its major reason would be the influences of the Russian crisis. Considering that the GDP drop in 1998 is 2.5%, the economic turbulence hit the household economy much harder than the national economy. See Table 1.2.1.

According to "Households of Almaty City in 1998", average monthly household income per person is KZT 5,656.8 in 1998. That in 1999 is estimated at KZT 5,827.0 with considering inflation rate (7.3%) and forecasted GDP growth rate (-4.0%). The highest income category is Physical Workers, whose income is KZT 6,249.3 and the lowest is Pensioners' KZT 4,492.2

2) Breakdown of Household Income and Expenditure

Pensioners' income is KZT 4,361 per month per person in 1998 which is about by 23% lower than the average. In addition, pensions account for 79.3% of their income resource, which means that their lives are highly affected by the deferment of pension payment.

In terms of expenditure, pensioners spend KZT 4,354.2 per person per month. Their balance between income and expenditure is only KZT 6.8 or 2.4% of the average. Payment for services including utility supply and solid waste collection accounts for 44.1%, which is remarkable because those for other job categories are less than 30%. It is not surprising that pensioners are very sensitive to increases in service charges. See Table 1.2.2.

3) Distribution of Household Income

Almaty City Statistical Department performed a household survey in February 1999. Income distribution is presented as follows:

Income Distribution (as of Feb 1999)

Monthly income per person (KZT)	Frequency	Relative Frequency	Accumulated Relative Frequency
0 - 1,320	4	1.0%	1.0%
1,320 - 2,640	40	10.3%	11.3%
2,640 - 3,960	76	19.5%	30.8%
3,960 - 5,280	93	23.8%	54.6%
5,280 - 6,600	66	16.9%	71.5%
6,600 - 7,920	34	8.7%	80.3%
7,920 - 9,240	21	5.4%	85.6%
9,240 - 10,560	17	4.4%	90.0%
10,560 - 11,880	10	2.6%	92.6%
11,880 - 13,200	6	1.5%	94.1%
13,200 -	23	5.9%	100.0%
Total	390	100.0%	-

Source: Almaty City Statistical Department

According to the data, 30.8% of the samples earn less than KZT 4,000. Median is calculated at KZT 5,025, or 50% of the samples earn less than KZT 5,025.

Summary of Statistical Data

Statistical Data	Income: KZT, per person per month
Mean	5,726
Median	5,025
Mode	4,620
25% point	3,569
75% point	7,124
Quartile Range	3,557

As shown in the above data, the order of the three data is Mode < Median < Mean. It means that the distribution curve is not symmetrical and is skewed to the right, which is frequently seen in social phenomena.

1.2.3 City Government Budget for Solid Waste Management

1) Waste Collection

Presently the sold waste management services are all privatized. Waste collection for households and industries is carried out by private companies without any control by the government. The city government allocates no budget for such services.

2) Management of Transfer Stations and the Final Disposal Site

One private company is running the business of transfer stations and the final disposal site. The city government allocates no budget for the operation of transfer stations and the final disposal site.

A budgetary source comes from the Almaty Environmental Protection Fund, which is under the supervision of Ministry of Natural Resources and Environment Protection. Its main revenues are charges related to the environmental pollution. Tariff rates are set by the Ministry and City Akim. 50% of collected money is sent to the Republic and the remaining 50% to the city. Such money is spend for the environmental action plan which include a new transfer station, rehabilitation of existing transfer stations, the disposal site and illegal dump sites. The action plan should be approved by the Ministry and the City Akim. KZT 4 million or 11% of all the revenues to the fund is planned to be earmarked for solid waste management in 1999.

3) Street Cleansing

Street cleansing survives are supplied by a Joint Stock Company "Road Exploitation Department", which was formerly a organization of the City Government but was privatized as a whole department. They clear the roads for cars and bus stops (road: 1,336km, bus stops: 1,400 in total). Structure of the shareholders are 71.5% by the Republic Government and the remaining by employees.

Their revenue comes from only the City Financial Department through a JSC "Landscape Department", which is something like a parent company. It was 240 million KZT/year by 1995 but has been reduced to 130 million KZT/year from 1996 due to financial collapse of the Government. 80% of the business profit goes to the Republic

1.2.4 Business Conditions of Waste Collection Companies

Presently tariffs of solid waste management are set by the Antimonopoly Committee of Almaty City as follows:

Tariffs

(As of July 1, 1998)

Service Type	Tariff
Household waste collection	
Block houses with full utility	25.15 KZT/person/month
Block houses with partial utility	33.53 KZT/person/month
Individual houses	55.89 KZT/person/month
Industrial waste collection	335.34 KZT/m^3
City dump site	35.24 KZT/m^3
Transfer station	81.89 KZT/m^3
Waste recycling mill	170.49 KZT/m^3

Source: Antimonopoly Committee of Almaty City

In our interview survey a number of companies complains that running waste collection business is very hard. Tariffs for household and industrial waste collection were set in 1997 and not revised yet. Costs such as fuel, electricity, etc. have increased to twice since then. In addition, social tax (21.5% of salaries after pension fund payment) corporate income tax (30%) and VAT (20%) are levied.

Another problem is that tariff collection rate is about 70% with rough estimation. In other words, around 30% of people receiving services do or can not pay the tariff.

But collection companies virtually have no mechanism to force the people to pay the tariff. Legal procedure such as appealing to the court is time consuming and costly comparing with yearly debt of the resident amounting to much less than $10 (KZT 25.15 x 12 months = KZT 301.8).

In some cities in other countries, as a mechanism to force the people to pay the waste collection charge, water supply is disconnected for those do not pay. It is impossible here to stop utility supply to families which do not pay waste collection charge since utility companies and waste collection companies are different. In addition, because supplying lines for heating, water, and gas cannot be disconnected for individual apartments with a mechanical reason, utility supply to those paying the charge would be stopped by disconnecting lines for those not paying.

1.2.5 Business Conditions of KSK/KSD

In case of KSKs (cooperatives for block house management), each family pays the fees to a savings bank. Computer center of the bank calculate and distributes money to the water supply company, electricity company, telephone company, waste collection company and KSKs for their building maintenance services. On the other hand, in case of KSDs (cooperatives for individual house community management), people come to the office and directly pay the charges because KSDs are located in the suburbs of the city. The KSDs pay the collected fees to a bank. In both cases, they get 1.5% commission from utility supplying companies for delivering bills and administrating charge collection. But this revenue is very small. Their main revenues are those from building or community management services.

KSKs/KSDs have no liability for collecting charges. Thus, supplying companies sue people not paying.

Some KSKs or KSDs assume solid waste collection services with leasing trucks and hiring drivers in case that the services provided by the collection companies are not satisfied. In this case, they face the same problems as the collection companies do.

CHAPTER 2 FORECAST OF ECONOMIC SITUATION

2.1 KAZAKHSTAN-2030

President Nursultan Nazarbayev published a long-term national program "Kazakhstan 2030" in 1997. It aims that Kazakhstan will become an Asian NIEs country such as Singapore, Malaysia, etc. in 2030. Confusion and production decline after the economic system transition required a long-term goal. As many examples are shown on economic development in oil-rich developing countries with failing diversify their economic structure, knowledge and technology based competitiveness is fundamentally more important than any amount of natural resources. The paper says, "The government must set about launching an active industrial policy of diversification...."

As for the industrial policy for the medium-term, until the year of 2010 it concentrate on labor-intense sectors which have a potential from the viewpoint of their opportunities and competitiveness. Such sectors include agriculture, forestry and timber processing industries, light and food industries, tourism, housing construction and the building of infrastructure. By developing these sectors they are solving not only the structural problems of the economy, but also issues of employment and poverty, which at present time is particularly important.

On the other hand, the development of the energy and other natural resources will continue by introducing larger foreign investments. Its purpose is to earn export revenues which will assist not only the economic growth but the political stability of the country as well as providing for its national security.

2.2 FUTURE OIL PRICE

Kazakhstan's economy is highly exposed to the conditions of world commodity markets especially to oil prices. Thus, it is important to examine future oil price scenario for making economic forecast of Kazakhstan. In 1998, international oil markets are characterized by a structural glut, or supply exceeds demand. Demand was falling due to the Asian financial crisis. And supply was increasing by the production in Iraq and many other countries. As a result, oil price showed a historically low level in 1998. Since it is expected that in 2000, the world economy will recover from the recent sluggishness, oil prices will increase form the present level. But according to the forecasts made by Petroleum Economics Ltd., oil prices should not be expected to rise significantly and should be stable over the medium-term. See Table 2.2.1.

2.3 GLOBAL ECONOMIC PROSPECTS

According to the IBRD report, "Global Economic Prospects, 1998/99", despite the gloomy near-term outlook, world economic growth in the medium-term part of the forecast (2001-07) is projected at 3.2% a year. But some downward revisions have been made from the previous issue reflecting the recent economic situations. First, among the industrial countries, projections for Japan have been reduced to 2-2.4% in 2001-07, which is in the range of other industrial countries. Second, growth projections for the countries in the CIS and in South Asia have also been reduced.

Third, the biggest reductions have been made for the crisis-affected countries in East Asia (Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand).

The prospects for Russia and the other CIS countries, is now much more unclear. Financial crisis and a new government of uncertain policy intentions have blown up expects for a near-term recovery in Russia. It is expected that Russia's economy shows a decline of 4-6% in 1998, followed by a similar reduction in 1999. Attaining a long-term growth depends on how they will successfully achieve institutional reforms, economic stabilization, and tax and financial reforms that supply public resources as well as they will support the development of private sector. Recent economic turbulence has emphasized the institutional vulnerability of CIS countries. The IBRD report presented, "With growth in Russia falling or severely constrained, and Central Asia hurt by developments in commodity markets, **10-year growth projections for the region as a whole have been lowered to 2.6%**, a major 2.4 percentage point revision." See Table 2.3.1.

2.4 FUTURE GROWTH OF KAZAKHSTAN ECONOMY

According to a UK economic information service company, the Economic Intelligence Unit (EIU), real GDP growth rate is forecasted as -4.0% in 1999 and 2.0% in 2000 with saying that "Real GDP growth in the first nine months of 1999 was zero. The recession will be severe because of the lack of vigorous enterprise restructuring. .....In 2000 the recovery in oil and other raw materials exports should lead to 2.0% real GDP growth rebound." See Table 2.4.1.

Considering the analyses of the IBRD and EIU, **it may be possible to expect that Kazakhstan's economy will grow at around 2.0% level from 2000 to 2010** with the conditions that

(1) The recovery of world economy and oil prices are realized in 2000;

(2) Kazakhstan's institutional reforms progress fundamentally; and

(3) The fiscal deficit is well controlled by the Government.

2.5 GROSS REGIONAL DOMESTIC PRODUCT (GRDP) OF ALMATY CITY

Gross Regional Domestic Product (GRDP) of Almaty City is the total value produced in the city, which is frequently referred to for a base of the economical limitation (the final base of financial limitation) of the SWM. The ratio of GRDP of Almaty City to GDP is 13.8% in average of the last three years. Gross Domestic Product (GDP) is forecasted to grow at 2% from year 2000 as mentioned above. Thus, the GRDP can be calculated as follows.

GDP and GRDP of Almaty City (forecast)

	1999	2000	2005	2010
GDP (KZT bn; at 1999 price)	1,812.0	1,848.3	2,040.6	2,253.0
GDP Growth Rate	-4.0%	2.0%	2.0%	2.0%
GRDP (KZT bn; at 1999 price)	250.2	255.2	281.7	311.1

Sources: Agency of Economic Planning, Economist Intelligence Unit, and JICA Study Team

2.6 FORECASTED HOUSEHOLD DISPOSAL INCOME IN 2000-2010

Household disposal income per person in the project years 2000-2010 is estimated with the assumption that it grows in accordance with the real GDP growth rate.

Household Disposable Income (Forecast)

(per person, monthly; KZT)

	1999	2000	2005	2010
Average	5,547.1	5,658.0	6,246.9	6,897.1
Physical Workers	5,927.0	6,045.5	6,674.7	7,369.5
Office Workers	5,725.6	5,840.1	6,448.0	7,119.1
Non-Governmental	4,886.9	4,984.6	5,503.4	6,076.3
Pensioners	4,492.2	4,582.0	5,058.9	5,585.5

Source: JICA Study Team

Table 1.1.1 Export structure by Commodities

(USD m)

	1996		1997	
Fuel, Oil products	1,942.6	32.9%	2,084.9	32.7%
Ferrous metals	876.7	14.8%	950.9	14.9%
Copper and copper products	618.8	10.5%	699.9	11.0%
Inorganic chemicals	395.7	6.7%	352.0	5.5%
Grain	428.6	7.3%	511.7	8.0%
Precious metals	21.3	0.4%	133.1	2.1%
Zinc and zinc products	145.9	2.5%	219.6	3.4%
Ores, slag and cinders	134.0	2.3%	244.6	3.8%
Reactors, machinery	152.7	2.6%	113.3	1.8%
Salt, sulfur, stone	102.7	1.7%	67.0	1.1%
Cotton	102.8	1.7%	81.7	1.3%
Others	989.2	16.7%	907.6	14.3%
Total	5,911.0	100.0%	6,366.3	100.0%

Source: *Kazakhstan Economic Trends, October - December 1998*

Table 1.1.2 Export structure by Countries

(USD m)

	1996		1997	
CIS	3,178.9	53.8%	2,851.2	44.8%
Russia	2,484.4	42.0%	2,157.1	33.9%
Ukraine	212.5	3.6%	303.5	4.8%
Uzbekistan	201.8	3.4%	148.4	2.3%
Kyrgystan	111.6	1.9%	66.2	1.0%
Other CIS countries	168.6	2.9%	176.0	2.8%
European Union	1,095.4	18.5%	1,707.5	26.8%
Netherlands	303.0	5.1%	203.6	3.2%
Germany	183.0	3.1%	353.0	5.5%
United Kingdom	230.8	3.9%	548.7	8.6%
Italy	197.1	3.3%	357.3	5.6%
Other EU countries	181.5	3.1%	244.9	3.8%
Other Countries	1,636.7	27.7%	1,807.6	28.4%
China	458.9	7.8%	442.2	6.9%
USA	59.4	1.0%	139.2	2.2%
Turkey	51.7	0.9%	102.2	1.6%
Switzerland	211.4	3.6%	285.6	4.5%
Others	855.3	14.5%	838.4	13.2%
Total	5,911.0	100.0%	6,366.3	100.0%

Source: *Kazakhstan Economic Trends, October - December 1998*

Table 1.1.3 Import structure by Commodities

(USD m)

	1996		1997	
Fuel, Oil products	807.4	19.0%	611.6	14.3%
Reactors, machinery	521.8	12.3%	700.0	16.4%
Electric Equipment	292.2	6.9%	333.4	7.8%
Vehicles	302.2	7.1%	258.7	6.1%
Ferrous metal products	261.5	6.2%	257.5	6.0%
Sugar and confectionery	139.0	3.3%	133.4	3.1%
Rubber, rubber products	171.0	4.0%	97.6	2.3%
Inorganic chemicals	102.4	2.4%	102.6	2.4%
Optical devices	66.5	1.6%	88.0	2.1%
Ferrous metals	121.6	2.9%	106.3	2.5%
Paper and carton	91.5	2.2%	93.6	2.2%
Alcohol, soft drinks	107.1	2.5%	121.3	2.8%
Others	1,256.9	29.6%	1,371.1	32.1%
Total	4,241.1	100.0%	4,275.1	100.0%

Source: *Kazakhstan Economic Trends, October - December 1998*

Table 1.1.4 Import structure by Countries

(USD m)

	1996		1997	
CIS	2,945.5	69.5%	2,306.5	54.0%
Russia	2,324.6	54.8%	1,965.7	46.0%
Ukraine	92.3	2.2%	93.3	2.2%
Uzbekistan	89.3	2.1%	65.6	1.5%
Belarus	120.5	2.8%	58.4	1.4%
Other CIS countries	318.8	7.5%	123.5	2.9%
European Union	553.8	13.1%	925.0	21.6%
Germany	197.7	4.7%	367.7	8.6%
United Kingdom	76.5	1.8%	141.4	3.3%
Italy	42.2	1.0%	84.7	2.0%
Finland	56.1	1.3%	67.8	1.6%
Other EU countries	181.3	4.3%	263.4	6.2%
Other Countries	741.8	17.5%	1,043.6	24.4%
China	35.8	0.8%	46.6	1.1%
USA	66.3	1.6%	201.7	4.7%
Turkey	151.2	3.6%	177.0	4.1%
South Korea	87.8	2.1%	129.5	3.0%
Others	400.7	9.4%	488.8	11.4%
Total	4,241.1	100.0%	4,275.1	100.0%

Source: *Kazakhstan Economic Trends, October - December 1998*

Table 1.1.5 Industrial Production

(% change on previous year)

	Electricity	Fuel	Ferrous metallurgy	Non-ferrous metallurgy	Chemicals	Machine building	Construction materials	Light Industry	Food industry	Total
1996	-9.1%	16.2%	-16.6%	3.2%	-21.4%	-9.3%	-34.5%	-17.9%	-10.6%	-9.8%
1997	-11.8%	11.4%	19.2%	16.8%	-27.8%	-23.7%	-27.3%	-19.2%	2.2%	-0.5%
1998	-4.1%	1.7%	-11.6%	4.8%	-20.7%	-23.7%	-31.3%	-11.0%	4.2%	-3.5%

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.1.6 Producer Prices

(% change on previous year)

	Total	Electric energy	Oil Extraction	Gas extraction	Ferrous metals	Nonferrous metals	Construction metals	Food industry
1995	231.2%	193.3%	381.8%	267.8%	215.6%	271.9%	304.2%	322.6%
1996	24.3%	14.6%	13.6%	40.3%	9.2%	12.8%	31.2%	45.0%
1997	15.6%	45.1%	13.1%	7.9%	0.4%	5.7%	14.1%	11.7%
1998	0.8%	11.6%	-5.1%	7.7%	-6.3%	-12.8%	5.2%	3.9%

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.1.7 Balance of Payments

(USD m)

	1995	1996	1997	1998 (I-III Q)
Current account	-518.3	-749.9	-912.3	-689.3
Trade balance	-222.4	-326.3	-385.4	-406.5
Services	-208.1	-253.7	-282.7	-139.1
Interest & other income	-146.8	-219.5	-318.8	-199.7
Current transfers	59.0	49.6	74.6	56.0
Capital & financial account	777.1	1,624.4	2,357.4	1,334.6
Capital transfers	-380.6	-315.5	-439.7	-306.1
Direct investment	964.0	1,136.9	1,319.9	724.1
Portfolio investment	7.2	223.5	404.2	25.3
Other investment	500.5	275.0	451.3	347.8
Other capital	-314.0	304.5	621.7	543.5
Errors & omissions	-103.9	-851.0	-965.5	-1,175.2
Overall balance	154.9	23.5	479.6	-529.9

Source: *Kazakhstan Economic Trends, October - December 1998*

Table 1.1.8 Foreign Direct Investment by Sectors

(USD m)

	1993-94	1995	1996	1997	I/1998	II/1998	III/1998
Oil and gas	1,519.8	315.1	387.1	718.0	133.5	168.5	217.8
Food industry	86.5	38.5	41.7	70.5	11.2	7.6	5.2
Ferrous metallurgy	0.0	102.1	122.9	110.6	0.0	0.0	0.0
Non-ferrous metallurgy	17.9	344.5	706.5	761.3	4.3	32.7	4.8
Energy complex	0.0	0.0	126.0	128.3	13.0	27.5	34.1
Mining industry	0.0	0.0	118.6	67.7	0.0	0.0	0.0
Communications	27.8	34.9	20.4	126.4	0.7	3.1	0.8
Consumer goods	0.0	0.0	56.1	12.1	5.1	5.3	4.4
Banking	19.0	11.9	3.4	25.9	1.8	18.5	27.6
Other	260.1	137.3	91.0	86.2	15.6	30.3	13.5
Total	1,931.1	984.3	1,673.7	2,107.0	185.2	293.5	308.2

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.1.9 Foreign Direct Investment by Countries

(USD m)

	1993-94	1995	1996	1997	I/1998	II/1998	III/1998
Belgium	1.3	0.0	107.8	27.8	3.2	2.0	3.0
Britain Virgin Islands	14.1	14.1	45.3	80.2	6.2	1.2	1.5
Great Britain	25.7	152.8	483.7	311.4	5.9	35.3	19.9
Germany	15.7	9.5	29.0	52.7	8.0	22.4	11.5
Indonesia	0.0	0.0	0.0	124.3	30.0	25.0	0.0
Island	0.0	0.0	84.3	65.5	1.7	1.3	0.1
Canada	16.0	35.1	132.3	22.8	4.7	21.4	2.9
China	10.0	2.0	0.0	313.0	68.0	1.2	0.1
USA	1,378.9	153.3	164.2	208.1	27.5	70.9	105.8
Turkey	134.2	79.3	75.6	65.0	11.1	54.7	11.3
Switzerland	0.0	4.1	44.7	31.1	7.5	13.1	10.8
South Korea	0.5	270.5	442.6	720.0	3.5	23.0	0.2
Japan	12.0	30.0	0.0	12.0	0.0	0.0	115.4
Other	322.7	233.6	64.1	73.1	7.9	22.0	25.7
Total	1,931.1	984.3	1,673.6	2,107.0	185.2	293.5	308.2

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.1.10 Consolidated State Budget (Revenue)

(KZT m)

	Total	Corporate income tax	Personal income tax	VAT	Excises	International trade taxes	Other taxes	Nontax revenues	Revenues from capital operations	Official transfers and grants
1995	185,013	33,857	25,717	33,302	7,401	12,766	30,897	28,122	12,766	0
1996	229,314	41,506	31,187	53,889	10,778	9,173	26,142	19,721	36,920	0
1997	279,719	40,280	41,398	58,741	16,783	8,112	38,881	15,944	59,300	280
1998	309,508	38,379	30,022	80,782	18,880	9,904	37,450	18,880	69,639	5,571

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.1.11 Consolidated State Budget (Expenditure)

(KZT m)

	Total	Government defense, security	Education	Health care	Social security	Recreation and culture	Economy			Other expen-ditures	Net Lending
							Agriculture	Mining, Manu-facturing	Others		
1995	222,085	56,854	43,307	29,759	15,546	9,772	7,107	1,555	9,772	58,186	-9,550
1996	262,965	74,682	62,849	35,763	27,874	11,570	12,359	4,207	3,156	22,089	8,415
1997	341,870	75,553	73,502	35,213	26,666	10,940	10,598	5,812	1,367	79,314	23,247
1998	373,397	81,027	68,332	25,764	53,396	11,575	5,974	1,867	373	100,817	23,897

Source: *Kazakhstan Economic Trends, Monthly Update, February 1999*

Table 1.2.1 Household Income Growth

(KZT per person per month)

	1994	1995	1996	1997	1998
Consumer Price Index	100.0	280.0	389.5	457.2	506.1
Monetary income at current price	1,113.5	3,066.5	4,131.8	5,368.9	5,656.8
Monetary Income at 1994 Price	1,113.5	1,095.2	1,060.9	1,174.2	1,117.8
Real Growth Rate	-	-1.6%	-3.1%	10.7%	-4.8%

Source: Amaty City Statistical Department, *"Statistic Yearbook of Almaty City, 1998"* and Economist Intelligence Unit *"Country Report Kazakhstan, 4th quarter 1998"*

Table 1.2.2 Monetary Income and Expenses of Households by Job Categories

(per person, monthly average)

Types of Monetary Income & Expenses	Average		Category of Job							
			Physical Workers		Office Workers		Non-Governmental		Pensioners	
	KZT	Percentage	KZT	Percentage	KZT	Percentage	KZT	Percentage	KZT	Percentage
Monetary Income Total	5,656.8	100.0%	6,066.8	100.0%	5,842.7	100.0%	4,963.0	100.0%	4,361.0	100.0%
Wages	4,681.1	82.8%	5,448.9	89.8%	5,141.3	88.0%	3,587.4	72.3%	0.0	0.0%
Pensions, Grants & Donations	510.0	9.0%	356.9	5.9%	491.1	8.4%	327.0	6.6%	3,457.3	79.3%
Other Income	465.7	8.2%	261.0	4.3%	210.3	3.6%	1,048.6	21.1%	903.7	20.7%
Monetary Expenditure Total	5,367.9	100.0%	5,689.5	100.0%	5,540.1	100.0%	4,797.1	100.0%	4,354.2	100.0%
Meals	2,583.5	48.1%	2,821.0	49.6%	2,518.8	45.5%	2,347.0	48.9%	2,025.4	46.5%
Non-Meal Goods	774.8	14.4%	819.4	14.4%	801.4	14.5%	735.4	15.3%	366.4	8.4%
Alcohol	58.0	1.1%	56.8	1.0%	76.3	1.4%	47.0	1.0%	10.3	0.2%
Services	1,475.2	27.5%	1,474.3	25.9%	1,609.6	29.1%	1,256.4	26.2%	1,921.9	44.1%
Taxes	271.7	5.1%	312.9	5.5%	284.3	5.1%	218.8	4.6%	0.0	0.0%
Other Expenditure	204.7	3.8%	205.1	3.6%	249.7	4.5%	192.5	4.0%	30.2	0.7%

Source: Almaty City Statistical Department, *"Households of Almaty City in 1998"*

Table 2.2.1 Long-Term Oil Price Scenarios

(in 1996 USD/bbl)

Institution/Scenario	date of forecast	2000	2005	2010	2020
Petroleum Economics Ltd.	Feb.98	15.31	13.97	13.14	n.a.
EIA Reference Case	Dec.97	19.11	20.20	20.81	22.32
EIA Low-Price Case	idem	14.47	14.59	14.44	14.43
DRI	Apr.97	17.29	19.27	21.07	26.16
EIA Capacity-Constraint Case	1996	18.18	26.73	26.73	n.a.
EIA Energy-Saving Case	1996	18.18	18.18	18.18	n.a.

Source: *EIA, 1998*

Table 2.3.1 Global Economic Prospects

(annual percentage change in real GDP)

				Forecasts				
				World Economic Prospects 1998/99				World Economic Prospects 1997/98
	1981-90	1991-97	1997	1998	1999	2000	2001-2007	2001-2006
World total	3.1	2.3	3.2	1.8	1.9	2.7	3.2	3.4
High-income countries	3.1	2.1	2.8	1.7	1.6	2.3	2.6	2.8
Developing countries	3	3.1	4.8	2	2.7	4.3	5.2	5.5
East Asian crisis countries	6.9	7.2	4.5	-8	0.1	3.2	5.2	6.8
Transition countries of Europe and Central Asia	2.4	-5.5	1.7	-0.4	-0.6	3	4.8	5.3

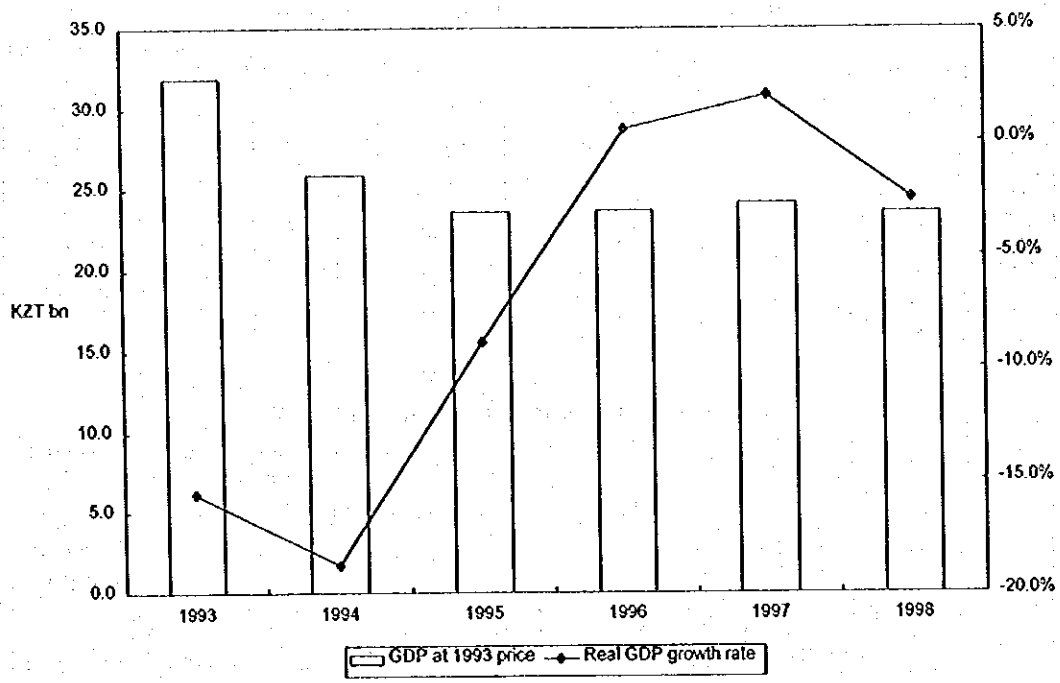
Source: IBRD, *"World Economic Prospects 1998/99"*

Table 2.4.1 Forecast Summary by EIU

(% change unless otherwise indicated)

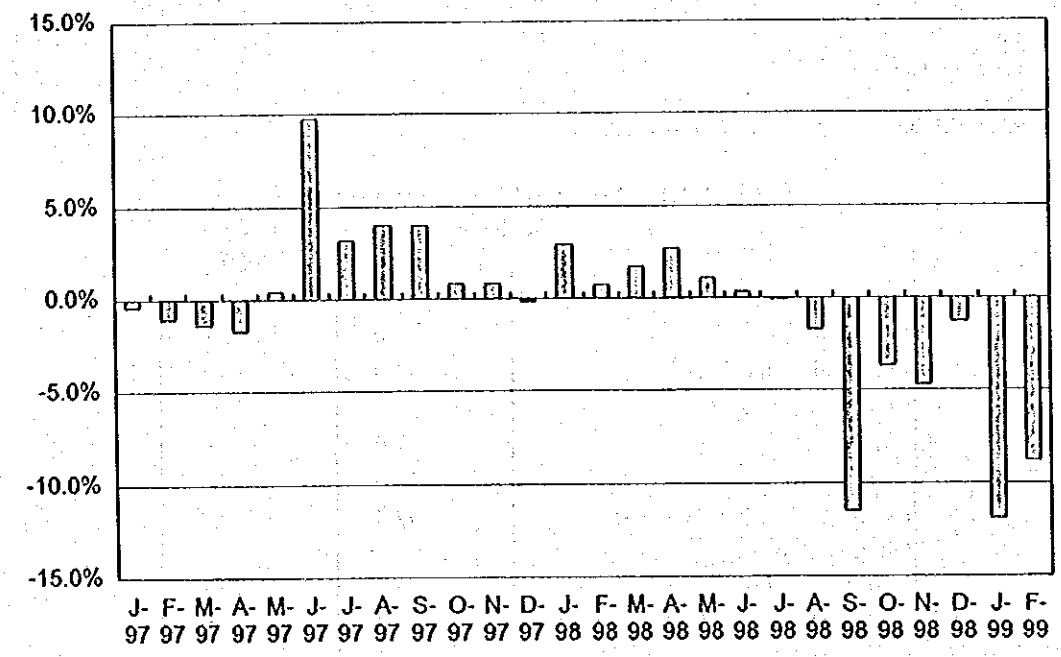
	1999 Forecast	2000 Forecast
Real GDP	-3.0	2.0
Industrial production	-4.0	5.5
Consumer prices		
Average	7.0	9.0
Year-end	13.0	7.0
Exchange Rate (av; Tenge:$)	92.3	102.2
Oil price ($/b)		
IEA import price	10.2	12.6
Kazakh export price	8.7	11.0
Exports ($ m)	5,623.0	6,511.0
Imports ($ m)	-6,671.0	-7,165.0
Trade balance ($ m)	-1,048.0	-654.0
Current-account balance ($ m)	-1,552.5	-1,260.2
% of GDP	-7.6	-6.7

Source: Economist Intelligence Unit, *"Country Report Kazakhstan, 4th quarter 1998"*



Source: Economic Intelligence Unit, *"Country Report Kazakhstan, 4th quarter 1998"* and Kazakhstan Economic Trends, *"Monthly Update February 1999"*

Figure 1.1.1 Real GDP Growth



Source: *Kazakhstan Economic Trends, Monthly Update February 1999*

Figure 1.1.2 Real GDP Growth (% change on previous year)

SECTION D

COLLECTION, HAULAGE AND TRANSPORTATION

CHAPTER 1 EXISTING CONDITIONS

1.1 PRIVATE COLLECTION COMPANIES

1.1.1 ACDEP Data

At the end of 1998 there were 34 private entities registered with Almaty City Department of Environmental Protection (ACDEP). The data of these entities is summarized in Table D.1.1

Briefly the following points are noted:

- Of the 34 entities there were 18 companies (joint stock companies) and the remaining were KSD's.
- Of the total 264 truck units; 14% of the trucks were owned by the entities and the remainder were leased
- By waste type; 66% of the total waste was domestic and the remainder was commercial
- There were 1,543 container platforms and 6,007 containers (Ave. 3.9 containers/ platform)
- By collection truck availability;

More than 30 trucks	20 to 29 trucks	10 to 19 trucks	3 to 9 trucks	1 or 2 trucks
3 entities	2 entities	4 entities	9 entities	16 entities

- Assuming truck haul capacities per trip and trip number per truck per day and comparing that with the stated waste amounts hauled by each company; 12 entities would require more than 5 trips per day for their trucks to collect the stated waste amounts. On the other hand 11 entities would need less than one trip per truck to collect their stated amounts. The numbers indicate that entities do not make proper estimates of their waste amount collected and the importance of measuring actual waste amounts collected.

Table D.1.1 Data on Waste Collection Entities from ACDEP (1998)

No. Company	District Registered	Empl.	Trucks			1998 Waste (m^3)			Facilities served				Trip/truck	
			Tot	Own	Rent	Tot	Comm.	Domestic	Organiz.	Resident	KSK	Platform	Container	in 1 day
1 TOO Ak-zhal	ALM	39	9	9	0	96,000	32,000	64,000	262	54,805	56	119	573	1.1
2 TOO Yntymak	ALM	53	33	0	33	144,813	48,000	96,813	426	68,867	64	145	562	0.
3 AOOT Parasat	ALM	372	15	15	0	204,400	98,800	105,600	313	71,568	59	196	972	1.8
4 TOO Adeelet	AUEZ	45	17	0	17	88,260	7,460	80,800	139	69,448	93	71	367	0.4
5 TOO Zhalyn	AUEZ	46	14	.0	14	92,128	4,328	87,800	37	48,012	77	105	320	0.1
6 TOO Namys	AUEZ	215	7	0	7	42,400	7,200	35,200	27	22.1	18	18	88	0.5
7 TOO Zaman-i	AUEZ	25	4	0	4	43,200	13,117	30,083	90	33,426	52	36	198	1.1
8 TOO Tyan Shan	BOST	901	38	1	37	198,732	60,620	138,112	726	57,935	63	436	1076	0.5
9 PKSK Elimay	BOST	87	2	2	0	18,865	1,170	17,695	63	19,662	0	11	59	1.4
14 TOO Zhylservice	MED	5	3	2	1	19,600	3,600	16,000	20	17,816	11	20	58	0.5
11 MK Basis	ZHEUT	3	3	0	3	28,652	12,452	16,200	58	18,000	3	34	196	1.3
10 TOO Zhibek-zhal	ZHEUT	50	20	0	20	77,680	34,080	43,600	238	50,501	78	88	350	0.5
12 KSID Saken	ZHEUT	7	3	0	3	9,400	3,000	6,400	20	3,900	0	3	6	0.5
13 TOO Matibo	ZHEUT	5	6	0	6	36,391	11,016	25,375	15	281,946	6	16	48	4.9
15 TOO Zhas	MED	65	30	8	22	76,904	14,104	62,800	233	41,564	68	111	722	0.1
16 TOO Diamond-Tazalyk	MED	39	12	0	12	10,912	3,376	7,536	249	14,355	16	61	90	0.2
17 TOO Bek	TURK	36	23	0	23	36,000	9,200	26,800	234	23,191	49	73	322	0.3
18 TOO Spectrans	TURK	3	2	0	2	76,400	76,400	0	39	0	0	0	0	11.3
19 TOO Crif	TURK	5	3	0	3	21,820.	21,820	0	15	0	0	0	0	2.2
20 TOO Arystan	TURK	3	2	0	2	7,628	7,628	0	0	0	0	0	0	3.3
21 PKSD Poleena	TURK	3	1	0	1	2,300	0	2,300	0	1,500	0	0	0	0.0
.22 PKSD Altay	TURK	4	1	0	1	3,800	0	3,800	0	2,850	0	0	0	11.9
23 PKSD Kazakhstan	TURK	5	1	0	1	2,300	0	2,300	0	1,520	0	0	0	8.2
24 PKSD Zandysh	TURK	6	1	0	1	4,800	0	4,800	0	1,500	0	0	0	1.3
25 PKSD Zhana Kulylys	TURK	6	1	0	1	2,300	0	2,300	0	1,860	0	0	0	7.0
26 PKSD Kalas	TURK	6	1	0	1	2,200	0	2,200	0	1,500	0	0	0	9.6
27 PKSD Vesna	TURK	15	1	0	1	2,200	0	2,200	0	5,200	0	0	0	17.5
28 PKSD Zesnoy	TURK	3	1	0	1	3,500	0	3,500	0	1,300	0	0	0	2.1
29 PKSD Aydar	TURK	3	1	0	1	2,000	0	2,000	0	1,560	0	0	0	24.1
30 PKSD Rakhat	TURK	25	2	0	2	9,400	0	9,400	0	7,550	0	0	0	14.5
31 PKSD Alma	TURK	3	1	0	1	1,100	0	1,100	0	1,772	0	0	0	22.1
32 PKSD Eleron	TURK	29	1	0	1	8,900	3,246	5,654.	10	4,060	0	0	0	8.2
33 PKSD Azat	TURK	9	4	0	4	4,800	0	4,800	0	4,000	0	0	0	4.3
34 PKSD Arsu	TURK	9	1	0	1	1,800	0	1,800	0	1,800	0	0	0	37.8
Total	Almaty City	2,130	264	37	227	1,381,585	472,617	908,968	3,214	912,990	713	1,543	6,008	201.6

1.1.2 Private Companies Survey by the Study

A survey was conducted by the Study for the private collection entities in August 1999. Results are shown in Table D.1.2. The results reflect the many changes that are taking place at this time. These are summarized as follows:

- Four entities have disappeared and two new ones created
- Employee number in 1999 fell to 30% of that in 1998.
- Truck number fell from 264 to 200 units
- Reported collected waste is similar in both years

Table D.1.2 Private Entities Survey in August 1999

Company name	Staff	Total trucks	Truck average age	Reported waste collected (t/d)
1. TOO Adeleet	57	11	5.6	51
2. TOO Zhalyn	50	14	22.5	82
3. TOO Namys	10	7	5.9	32
4. TOO Zaman-ay	15	6	11.8	42
5. TOO Ak-zhol	33	10	8.7	67
6. TOO Yntymak	64	25	4.7	123
7. TOO Tyan-Shan	85	32	7.6	115
8. AOOT Parasat	42	17	3.3	90
9. TOO Zhilservice	4	3	1.5	12
10. TOO Zhas	70	26	6.3	75
11. TOO Diamond-Taz	25	8	9.6	70
12. TOO Zhibek-zholy	53	13	6.1	75
13. TOO Bek	15	3	5.0	18
14. TOO Vasa	13	4	0.1	31
15. TOO Matibo	4	2	12.0	9
16. KSD Kolos	6	1	4.0	7
17. KSD D Alma	10	1	7.0	3
18. KSD Vesna	6	2	4.0	10
19. KSK Lesnoy	8	1	7.0	3
20. KSD Aydar	2	1	10.0	2
21. KSD Kazakhstan	7	1	2.0	3
22. KSD Saken	10	2	20.5	6
23. KSD Landysh	7	1	10.0	3
24. KSD Eleron	18	1	6.0	6
25. KSD Polina	3	1	14.0	3
26. KSK Altay I	3	1	11.0	4
27. KSK Elimay	9	2	0.5	8
28. KSK Arzy	8	1	11.0	5
29. KSD Pakhat	8	2	6.5	10
30. Zhana-Kurly	4	1	10.0	5
Total	649	200	7.6	967.3

Table D.1.3 shows the trucks by type.

Table D.1.3 Truck Availability by Type

No.	Truck type	Number
1	KO 413	60
2	KO 415	8
3	KO 424	20
4	KO 431	17
5	KO 442	1
	Sub-total Side Loader	106
6	Gaz Dump Truck	31
7	ZIL Dump Truck	56
	Sub-total Dump Trucks	87
	Total Trucks	193

1.1.3 Conditions of the Collection Entities at their Creation

Based on the Almatyecologostroi Study prepared in 1996, the number of trucks distributed to the private collection entities at the time of their creation was 168 units. This is shown in Table D.1.4. At that time there were nine districts and the companies were created in each.

Table D.1.4 Collection Trucks in 1996

No.	District	53M	KO413	KO415	KO424	ML	Tot
1	Aksaiki	1	10	2	1	1	15
2	Alatauski	6	7	3	0	0	16
3	Almalinski	2	14	0	4	2	22
4	Auezovski	5	12	0	2	2	21
5	Bostandykski	3	8	1	4	4	20
6	Zhetysuski	2	10	0	2	2	16
7	Medeuski	7	11	0	0	1	19
8	Moskobski	5	10	1	1	2	19
9	Turksibski	5	12	0	1	2	20
	TOTAL	36	94	7	15	16	168
	Share of total (%)	21%	56%	4%	9%	10%	100%

Based on the registration figures of ACDEP, roughly 100 truck units were purchased during the last 3-4 years. Based on the results of the 1999 survey, about 50 dump trucks were newly purchased.

1.2 OPERATION INDICATORS

(1) Time and Motion Results

Survey results in Winter are summarized in Table D.1.5.

Table D.1.5 Winter Time and Motion Results

No.	Type	Trip	Dump site	Cont. No.	Ton/ shift	Minute/ ton	Collection route time share (%)
(1) MEDEUSKI							
1	KO 431	2	Barys	28	6.9	82	44%
2	KO 431	2	Barys	34	7.8	63	57%
3	KO 431	2	Barys	33	6.8	73	38%
4	KO 431	3	Barys	20	8.5	64	29%
5	MMZ	2	Barys	---	NA	NA	----
(2) AUEZOVSKI							
6	KO 413	4	Barys	66	8.8	49	38%
7	KO 431	3	Barys	59	7.9	39	45%
8	KO 424	5	Barys	97	12.9	39	53%
9	KO 424	3	Barys	61	8.2	44	52%
10	KO 413	4	Barys	76	10.1	45	39%
11	KO 413	3	Barys	52	6.1	48	35%
12	KO 424	4	Karasai	72	9.6	61	25%
13	KO 424	4	Karasai	85	11.2	47	28%
14	KO 424	3	Karasai	50	6.7	65	31%
15	KO 413	2	Karasai	30	4.0	97	14%
(3) ALMALINSKI							
16	KO 413	3	Compost Plant (2) Karasai (1)	51	6.7	74	41%
17	KO 415	2	Barys	134	18.0	30	55%
18	KO 413	4	Compost Plant (2) Nikka (2)	63	8.3	65	27%
19	KO 424	3	Barys	52	6.9	76	43%
20	MMZ	2	Barys	0	---	---	33%
21	Gaz DT	3	Barys	0	---	---	44%
22	KO 413	4	Barys	64	8.9	69	36%
23	KO 413	4	Barys (3) Compost Plant (1)	65	8.6	77	49%

(4) BOSTANDYKSKI							
24	KO 431	2	Karasai	48	6.4	65	69%
25	KO 431	2	Karasai	43	5.7	61	47%
26	KO 424	3	Karasai	52	7.0	78	31%
27	KO 431	3	Karasai	65	8.7	67	36%
28	KO 424	3	Karasai	62	8.2	72	36%
29	KO 413	3	Karasai	53	7.1	69	33%
30	KO 424	2	Karasai	37	4.9	97	45%
31	KO 424	2	Karasai	44	5.9	57	31%
(5) ZHETEUSUSKI							
32	KO 424	3	Compost plant	74	9.9	38	64%
33	KO 413	3	Compost plant	64	8.6	48	63%
34	KO 424	3	Compost plant	67	8.9	39	51%
35	KO 413	3	Compost plant	57	7.6	51	46%
36	KO 413	3	Compost plant	59	7.8	51	63%
37	KO 413	3	Compost plant	61	8.2	51	56%
(6) TURKSIBSKI							
38	KO 413	2	Spasskaya	39	5.2	41	50%
39	KO 413	2	Barys	42	5.6	80	32%
40	KO 413	3	Spasskaya	66	8.8	39	60%

(2) Waste Amount Survey

Trucks delivering the waste to 12 locations were surveyed for one week in each of winter and summer seasons. The following results were gained from these surveys.

Table D.1.6 Truck Haul Capacities (ton/trip)

Truck	Average haul (ton/trip)			Summer	Winter	Annual
Type	Compost	Transfer	Karasai	Average	Average	Average
1. Zil Dump Truck	1.7	3.0	1.6	2.1	1.3	1.7
2. Zil Flat Bed	None	0.5	None	0.5	None	0.5
3. Gaz Dump Truck	1.7	2.2	2.6	2.2	2.0	2.1
4. Kamaz Dump truck	None	None	2.4	2.4	None	2.4
5. Multi-loader	None	1.6	None	1.6	2.0	1.8
6. Tractor	None	1.8	None	1.8	None	1.8
7. KO 413	2.7	1.4	2.9	2.3	2.8	2.6
8. KO 424	3.1	0.5	3.3	2.3	2.9	2.6
9. KO 431	3.2	0.6	3.2	2.3	3.0	2.7
10. KO 415	None	None	8.4	8.4	8.5	8.4
11. Kamazk bM2	None	None	8.8	8.8	8.9	8.9

Table D.1.7 Trip production by truck (ave. trip/day)

Truck type	Karasai	Compost plant	Transfer Station	Spass-kaya	City ave.
1) Zil Dump truck	1.2	3.3	1.3	1.8	1.6
2) Zil flat bed	1.0	---	1.0	1.8	1.2
3) Gaz Dump truck	1.0	2.2	2.5	1.5	1.6
4) Kamaz Dump truck	1.2	---	---	1.6	2.1
5) Multi loader	---	---	---	1.0	1.5
6) Tractor	---	---	2.6	1.8	2.2
7) KO 413	2.8	1.9	1.1	1.7	1.6
8) KO 424	1.9	1.8	1.0	2.0	1.6
9) KO 431	2.1	1.7	1.6	2.0	1.7
10) KO 415	2.1	---	---	2.3	1.9
11) Kamaz bM2	2.0	---	---	---	2.0

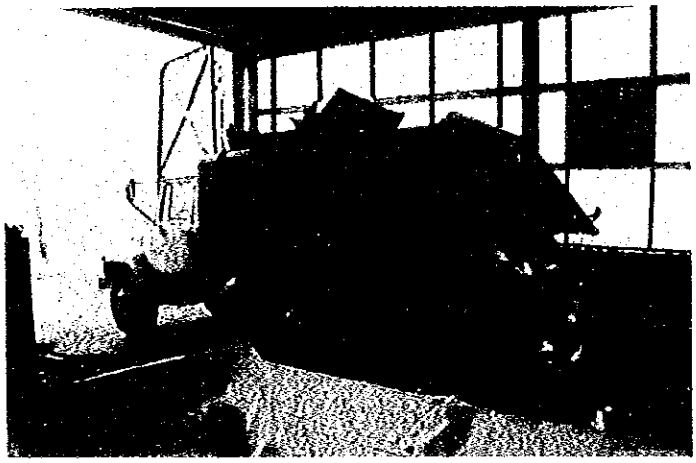
Table D.1.8 Maximum trucks used by type

Truck type	Karasai	Compost plant	Transfer Station	Spass-kaya	City ave.
1) Zil Dump truck	10	2	7	16	5.9
2) Zil flat bed	1	---	2	2	1.4
3) Gaz Dump truck	3	2	3	6	2.5
4) Kamaz Dump truck	2	---	---	5	2.4
5) Multi loader	---	---	---	1	1.0
6) Tractor	---	---	2	2	2.0
7) KO 413	4	15	2	8	7.3
8) KO 424	3	7	1	1	3.0
9) KO 431	13	14	2	2	7.8
10) KO 415	5	---	---	1	2.7
11) Kamaz bM2	8	---	---	---	8.0
Total maximum	51	40	21	44	189
Total average	34	31	10	26	113
Use efficiency (%)	67%	78%	48%	59%	60%

Table D.1.9 Almaty Waste O-D Table (ave. ton/d)

District	Karasai	Compost plant	Transfer station	Spasskaya	Total collected	Generated waste estimate	Share collected (%)
1) Almalinski	3.1	106.0	12.0	0.0	132.8	136.8	97%
2) Turksibski	3.6	0.0	0.0	109.6	113.2	199.0	57%
3) Medeuski	5.4	0.0	0.0	0.0	5.4	103.9	5%
4) Auezovski	71.4	0.0	0.0	0.0	72.8	195.6	37%
5) Bostandykski	38.0	0.0	0.0	0.0	64.2	114.2	56%
6) Zhetseuski	5.7	56.3	33.3	0.0	101.9	155.6	66%
7) City	0.8	0.0	0.0	0.0	0.0	0.8	
8) Compost	135.6	---	---	---	---	---	
9) Transfer	52.3	---	---	---	---	---	
Total	315.8	162.3	45.3	109.6	491.6	905.1	54%

Photo 1 Side loader loading waste from containers



CHAPTER 2 MASTER PLAN

2.1 COLLECTION EQUIPMENT

2.1.1 Compactor Truck 8 m^3

Compactor truck 8 m^3 is proposed in the master plan for individual housing areas and block housing areas in narrow streets. The truck shall be composed of a chassis and a superstructure (body volume 8m^3) and shall have enough capacity to load and transport waste in narrow streets with compressing device. It shall be equipped with a mechanical loading device for 1.1 m^3 containers in block housing areas. Loading shall be manual in individual housing areas.

1) Requirements for Chassis (example)

(1)	Type	Left-hand drive, forward control type, 4 x 2 traction
(2)	Dimensions (approximate)	Overall length: 6,700 – 7,200 mm Overall width: 2,200 – 2,300 mm Overall height: 2,900 – 3,200 mm Wheel base: 3,400 – 3,700 mm Ground clearance: 200 – 220 mm
(3)	Min. turning radius	Approx. 5,700 to 6,000 mm
(4)	Weight	Gross truck weight: 9 – 11 tons Max. payload: 3.5 – 4 tons
(5)	Max. speed	90 – 100 km/h
(6)	Gradeability (tan θ)	Approx. 30 – 35%
(7)	Engine	4 cycle diesel engine, Max. output, 160 – 180 PS
(8)	Clutch	Hydraulic control, dry single plate
(9)	Transmission	Not less than 5 forward and 1-reverse speed direct drive synchromesh 2^{nd} – 5^{th} Manual transmission
(10)	Rear axle	Full floating
(11)	Service brake	Air over hydraulic dual circuit or equivalent, Exhaust brake
(12)	Parking brake	Mechanical, internal expanding acting on propeller shaft
(13)	Steering	Ball nut type power steering
(14)	Suspension	Semi-elliptic laminated leaf springs
(15)	Fuel tank	Approx. 100 – 120 liters
(16)	Batteries	12 Volt × 2
(17)	Accessories	Floor mat, standard tool set, jack, spare tire, defroster and ventilator, radio, rotation lamp with amber color on the cabin roof and big size rear view mirrors (right and left)

2) Requirements for Body (example)

(1)	Body volume	Approx. 8m3, closed type, all steel welded construction with ejection plate
(2)	Hopper volume	Approx. 1 m3
(3)	Body thickness (high tensile steel)	Floor panel: Approx. 3.2 mm Side panel: Approx. 2.3 mm Roof panel: Approx. 2.3 mm Ejection panel: Approx. 2.3 mm
(4)	Hopper thickness (high tensile steel)	Side panel: Approx. 4.5 mm Floor panel: Approx. 6.0 mm Press panel: Approx. 4.5 mm
(5)	Loading time	Approx. 20 to 30 sec/cycle
(6)	Discharging time	Approx. 10 to 20 seconds
(7)	Hopper lock device	Hopper lock device (Automatic lock system) shall be provided at the lower side of the hopper, in order to lock the hopper with the body when the hopper is in the traveling and loading position
(8)	Control method	Mechanical hydraulic type, level control
(9)	Accessories	Illumination lamp for hopper
(10)	Paint	Rust proof coating

3) Requirements for Container Lifter (example)

(1)	Type	Arm lifting device for container 1.1 m^3
(2)	Lifting capacity	Not less than 700 kg (for container 1.1 m^3)
(3)	Cycle time	Up: max. 6 sec., Down: max. 4 sec.

(Container lifting device shall be designed taking into consideration the structure and specifications of container 1.1 m^3)

2.1.2 Compactor Truck 12 m^3

Compactor truck 12 m^3 is proposed in the master plan for block housing areas, commercial wastes from small generators and medical waste. The truck shall be composed of a chassis and a superstructure (body volume 12m^3) and shall have enough capacity to load and transport waste with compressing and discharging device. It shall be equipped with a mechanical loading device for 1.1 m^3 containers.

1) Requirements for Chassis (example)

(1)	Type	Left-hand drive, forward control type, 4 x 2 traction
(2)	Dimensions (approximate)	Overall length: 8,000 mm Overall width: 2,500 mm Overall height: 3,700 mm Wheel base: 4,000 mm

		Ground clearance: 250 mm
(3)	Min. turning radius	Approx. 7,000 mm
(4)	Weight	Gross truck weight: 17 tons Max. payload: 6 tons
(5)	Max. speed	90 – 100 km/h
(6)	Gradeability (tan θ)	Approx. 30 – 35%
(7)	Engine	4 cycle diesel engine, Max. output approx. 230 PS
(8)	Clutch	Hydraulic control, dry single plate
(9)	Transmission	Not less than 5 forward and 1-reverse speed direct drive synchromesh 2^{nd} – 5^{th} Manual transmission
(10)	Rear axle	Full floating
(11)	Service brake	Air over hydraulic dual circuit or equivalent, Exhaust brake
(12)	Parking brake	Mechanical, internal expanding acting on propeller shaft
(13)	Steering	Ball nut type power steering
(14)	Suspension	Semi-elliptic laminated leaf springs
(15)	Fuel tank	Approx. 130 liters
(16)	Batteries	12 Volt × 2
(17)	Accessories	Floor mat, standard tool set, jack, spare tire, defroster and ventilator, radio, rotation lamp with amber color on the cabin roof and big size rear view mirrors (right and left)

2) Requirements for Body (example)

(1)	Body volume	Approx. 12m^3, closed type, all steel welded construction with ejection plate
(2)	Hopper volume	Approx. 1 m^3
(3)	Body thickness (high tensile steel)	Floor panel: Approx. 3.2 mm Side panel: Approx. 2.3 mm Roof panel: Approx. 2.3 mm Ejection panel: Approx. 2.3 mm
(4)	Hopper thickness (high tensile steel)	Side panel: Approx. 4.5 mm Floor panel: Approx. 6.0 mm Press panel: Approx. 4.5 mm
(5)	Loading time	Approx. 20 to 30 sec/cycle
(6)	Discharging time	Approx. 30 to 45 seconds
(7)	Hopper lock device	Hopper lock device (Automatic lock system) shall be provided at the lower side of the hopper, in order to lock the hopper with the body when the hopper is in the traveling and loading position

(8)	Control method	Mechanical hydraulic type, level control
(9)	Accessories	Illumination lamp for hopper
(10)	Paint	Rust proof coating
(11)	Rear platforms	With hand grip (right and left)

3) Requirements for Container Lifter (example)

(1)	Type	Arm lifting device for container 1.1 m^3
(2)	Lifting capacity	Not less than 700 kg (for container 1.1 m^3)
(3)	Cycle time	Up: max. 6 sec., Down: max. 4 sec.

(Container lifting device shall be designed taking into consideration the structure and specifications of container 1.1 m^3)

2.1.3 Detachable Container (arm- roll) Truck 6 m^3

Detachable container truck 6 m^3 is proposed in the master plan for large generators of commercial wastes and markets. The truck shall be composed of a chassis and a superstructure (container lifting device) and shall have enough capacity to load, unload and transport a 6m^3 waste container.

1) Requirements for Chassis (example)

(1)	Type	Left-hand drive, forward control type, 4 x 2 traction
(2)	Dimensions (approximate)	Overall length: 6,500 mm Overall width: 2,300 mm Overall height: 3,200 mm Wheel base: 3,600 mm Ground clearance: 190 mm
(3)	Min. turning radius	Approx. 5,700 to 6,000 mm
(4)	Weight	Gross truck weight: 9 tons Max. payload: 3.5 tons
(5)	Max. speed	90 – 100 km/h
(6)	Gradeability (tan θ)	Approx. 30 – 35%
(7)	Engine	4 cycle diesel engine, Max. output, 160 PS
(8)	Clutch	Hydraulic control, dry single plate
(9)	Transmission	Not less than 5 forward and 1-reverse speed direct drive synchromesh 2^{nd} – 5^{th} Manual transmission
(10)	Rear axle	Full floating
(11)	Service brake	Air over hydraulic dual circuit or equivalent, Exhaust brake
(12)	Parking brake	Mechanical, internal expanding acting on propeller shaft
(13)	Steering	Ball nut type power steering

(14)	Suspension	Semi-elliptic laminated leaf springs
(15)	Fuel tank	Approx. 100 – 120 liters
(16)	Batteries	12 Volt × 2
(17)	Accessories	Floor mat, standard tool set, jack, spare tire, defroster and ventilator, radio, rotation lamp with amber color on the cabin roof and big size rear view mirrors (right and left)

2) Requirements for Container Lifter (example)

(1)	Lifting capacity	Not less than 5,500 kg (for container 6 m^3)
(2)	Dump angle	Approx. 70 deg.
(3)	Lifting speed	Loading: Approx. 25 seconds Unloading: Approx. 35 seconds
(4)	Dump speed	Rising: Approx. 25 seconds Lowering: Approx. 20 seconds
(5)	Power transmission	Transmission PTO
(6)	Oil pump	High pressure gear pump
(7)	Oil pump capacity	Approx. 52 liters/min
(8)	Safety device	Overload protection device (oil hydraulic type)
(9)	Operation	By control levers behind the cabin
(10)	Paint	Rust proof painting

(Container lifting device shall be designed taking into consideration the structure and specifications of container 1.1 m^3)

2.1.4 Container 6 m^3 Closed Type

6 m^3 container (closed type) will be distributed at locations such as markets and large generators of commercial wastes. The containers shall be lifted by the truck according to a fixed schedule which shall be decided based on the waste type and service area.

1) Requirements (example)

(1)	Type	All steel welded construction with closed type
(2)	Material	Steel sheet
(3)	Material thickness	Deck plate: Not less than 4.5 mm Side plate: Not less than 4.5 mm Front plate: Not less than 4.5 mm Roof plate: Not less than 3.2 mm Cover: Not less than 0.8 mm
(4)	Dimensions (approximate)	Overall length: 3,270 mm Overall width: 1,930 mm Overall height: 1,700 mm

(5)	Body volume	Not less than $6m^3$
(6)	Paint	Rust proof coating and finishing painting
(7)	Weight	Approx. 1,000 kg

2.2 TECHNICAL ALTERNATIVES CONSIDERATION

Four alternatives were studied in the master plan. The effect these alternatives had on the collection and transport activity was carefully considered because the cost of collection and transport can be very costly. Inputs in the estimation process are given in the following tables.

Table D.2.1 Domestic and Commercial Waste Collection in 2010

Collection zone	Domestic			Commercial	Medical	Street
	Full	Partial	Individual			
1. Almalinski	54.2	7.3	15.8	43.5	4.0	12.8
2. Auez. North	37.7	6.6	9.1	54.4	4.9	5.6
3. Auez. South	56.6	9.9	13.7	25.4	2.3	5.6
4. Bostandykski	69.7	5.7	9.3	10.9	1.0	9.1
5. Zhet. West	11.0	3.0	10.5	43.5	4.0	6.3
6. Zhet. East	16.4	4.5	15.8	36.3	3.3	6.3
7. Medeuski North	16.8	4.6	16.1	14.5	1.3	8.2
8. Medeuski South	11.2	3.1	10.7	10.9	1.0	8.2
9. Tursibski North	10.5	14.1	18.7	47.1	4.3	11.9
10. Turksibski South	10.5	14.1	18.7	50.8	4.6	11.9
Total	294.5	72.9	138.5	337.3	30.7	85.8

Table D.2.2 Distances traveled KM/day by alternative (2010)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Direct Haul
(1) Compactor 8m3					
1. Almalinski	311	305	359	359	1,343
2. Auez. North	119	113	192	192	627
3. Auez. South	312	303	369	369	1,106
4. Bostandykski	389	381	486	486	1,227
5. Zhet. West	127	127	201	201	681
6. Zhet. East	297	259	327	327	910
7. Medeuski North	371	276	636	339	831
8. Medeuski South	246	228	308	345	743
9. Tursibski North	370	75	938	100	1,609
10. Turksibski South	341	158	992	197	1,332
(2) Compactor 12 m3					
1. Almalinski	457	434	457	457	1,730

2. Auez. North	210	193	210	210	1,185
3. Auez. South	369	362	417	417	1,159
4. Bostandykski	580	531	580	580	1,511
5. Zhet. West	193	174	193	193	862
6. Zhet. East	248	67	67	67	935
7. Medeuski North	199	49	119	245	633
8. Medeuski South	212	43	57	299	548
9. Tursibski North	397	73	774	98	1,491
10. Turksibski South	98	41	329	49	517
(3) Arm roll 6 m3					
1. Almalinski	474	451	474	474	2,039
2. Auez. North	328	328	375	375	2,084
3. Auez. South	276	276	361	361	974
4. Bostandykski	160	160	267	267	520
5. Zhet. West	463	428	463	463	2,293
6. Zhet. East	519	480	519	519	1,979
7. Medeuski North	276	198	485	264	689
8. Medeuski South	200	200	286	302	746
9. Tursibski North	763	147	1,772	201	3,349
10. Turksibski South	810	351	2,010	401	3,211
TOTAL	10,116	7,212	15,020	9,156	38,865

Table D.2.3 Trip numbers per shift

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Direct Haul
(1) Compactor 8m3 in Individual Housing areas					
1. Almalinski	2.5	2.5	2.5	2.5	1.6
2. Auez. North	2.7	2.7	2.7	2.7	1.8
3. Auez. South	2.5	2.5	2.5	2.5	1.7
4. Bostandykski	2.3	2.3	2.3	2.3	1.6
5. Zhet. West	2.5	2.5	2.5	2.5	1.6
6. Zhet. East	2.4	2.4	2.4	2.4	1.5
7. Medeuski North	2.3	2.4	2.0	2.3	1.6
8. Medeuski South	2.2	2.2	2.2	2.1	1.5
9. Tursibski North	2.3	2.8	1.9	2.8	1.4
10. Turksibski South	2.3	2.6	1.8	2.6	1.5
(2) Compactor 8m3 in Block Housing areas					
1. Almalinski	3.9	3.9	3.9	3.9	2.2
2. Auez. North	4.4	4.4	4.4	4.4	2.4
3. Auez. South	3.9	3.9	3.9	3.9	2.3
4. Bostandykski	3.5	3.5	3.5	3.5	2.1
5. Zhet. West	4.0	4.0	4.0	4.0	2.1

6. Zhet. East	3.6	3.6	3.6	3.6	2.0
7. Medeuski North	3.4	3.6	2.9	3.6	2.1
8. Medeuski South	3.3	3.3	3.3	3.1	1.9
9. Tursibski North	3.4	4.8	2.6	4.8	1.8
10. Turksibski South	3.5	4.3	2.4	4.3	1.9
(3) Compactor 12 m3					
1. Almalinski	3.0	3.0	3.0	3.0	1.9
2. Auez. North	3.3	3.3	3.3	3.3	2.0
3. Auez. South	3.0	3.0	3.0	3.0	2.0
4. Bostandykski	2.8	2.8	2.8	2.8	1.8
5. Zhet. West	3.0	3.0	3.0	3.0	1.8
6. Zhet. East	2.8	2.8	2.8	2.8	1.7
7. Medeuski North	2.7	2.8	2.4	2.8	1.8
8. Medeuski South	2.6	2.6	2.6	2.5	1.7
9. Tursibski North	2.7	3.5	2.1	3.5	1.5
10. Turksibski South	2.8	3.2	2.1	3.2	16
(4) Arm roll trucks (the trip number for this truck type were discounted in the calculation to reflect unknown factors)					
1. Almalinski	5.7	5.7	5.7	5.7	2.0
2. Auez. North	7.8	7.8	7.8	7.8	2.2
3. Auez. South	5.5	5.5	5.5	5.5	2.2
4. Bostandykski	4.6	4.6	4.6	4.6	1.9
5. Zhet. West	5.9	5.9	5.9	5.9	1.8
6. Zhet. East	4.8	4.8	4.8	4.8	1.7
7. Medeuski North	4.3	4.7	3.1	4.7	1.9
8. Medeuski South	4.0	4.0	4.0	3.6	1.6
9. Tursibski North	4.3	10.5	2.5	10.5	1.4
10. Turksibski South	4.5	7.2	2.3	7.2	1.6
(A) Compactor 8m3 (Ave.)	3.0	3.2	2.9	3.2	1.8
(B) Compactor 12m3 (Ave.)	2.9	3.0	2.7	3.0	1.8
(C) Arm-roll (Ave.)	5.1	6.1	4.6	6.0	1.8

2.3 MAINTENANCE PLAN

The Master Plan recommends that general periodic inspection for the trucks leased from the Waste Authority be carried out by the leasing collection companies. However major repairs and maintenance works should be contracted out to specialized work shops. Each truck should have a repair and maintenance sheet listing the repairs, repair description, parts changes, costs involved, time required for pair, etc. These sheets should be available to be checked by the Waste Authority at any time.

An example of the check list prepared based on a review of requirements of Japanese truck manufacturers is given in Table D.2.4.

Table D.2.4 General periodic inspection list

Item	Inspection content	Before operation	Monthly	Yearly
A. TRUCK				
- Engine	Noise, start, exhaust, oil flow	X	X	X
B. OIL				
- Oil pump	Noise		X	X
	Oil flow		X	X
	Bolt tightening			X
- Oil cylinder	Loading			X
	Oil flow		X	X
	Damage in the removable part			X
- Oil motor	Noise		X	X
	Oil flow		X	X
	Bolt tightening			X
- Engine oil	Oil level in the tank	X		X
	Dirty (color)			X
	Strainer in the tank			X
	Filter change			X
- Rubber hose	Damages (wear, tear) to the hose		X	X
	Oil flow		X	X
- Oil pressure valve	Bolt tightening			X
	Operation			X
C. ELECTRICITY				
- Loading switch	Rubber water hose damage, placing		X	X
	Rear switch operation	X		
- Loading control	Remit switch, relay timer		X	X
- Unloading control	Remit switch tightening			X
	Lowering & raising switch tightening			X
	Dump remit switch tightening			X
- Distributor	Connectors, etc.			X
- Rotary slider	Armwire tightening			X
D. SAFETY FUNCTIONS				
- Emergency stop switch	Operation, switch installation	X	X	X
- Lower tailgate interlocking	Operation	X	X	X

The space and facilities required for a periodic maintenance and garage area for a fleet of 10 trucks is as follows:

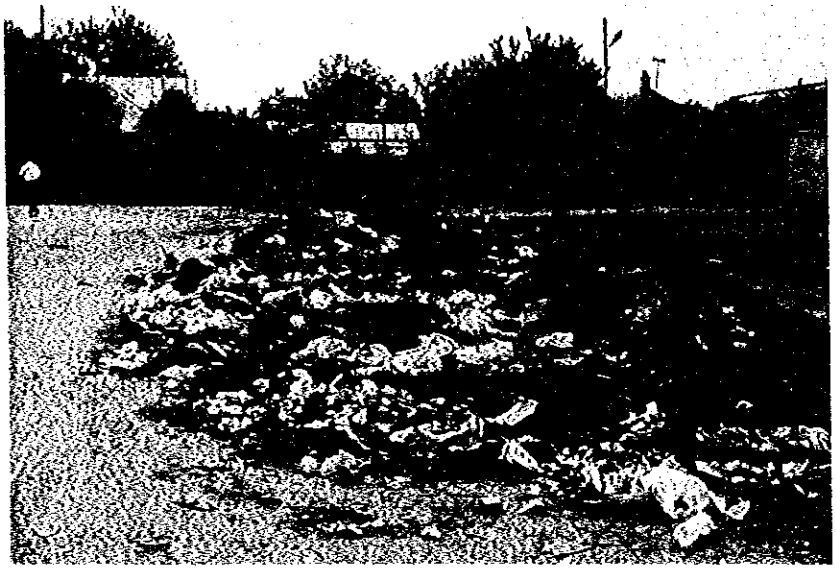
- Parking space: 12 bays
- Truck repair bays: 4 bays
- Maintenance and tires: 6 bays
- Container maintenance area

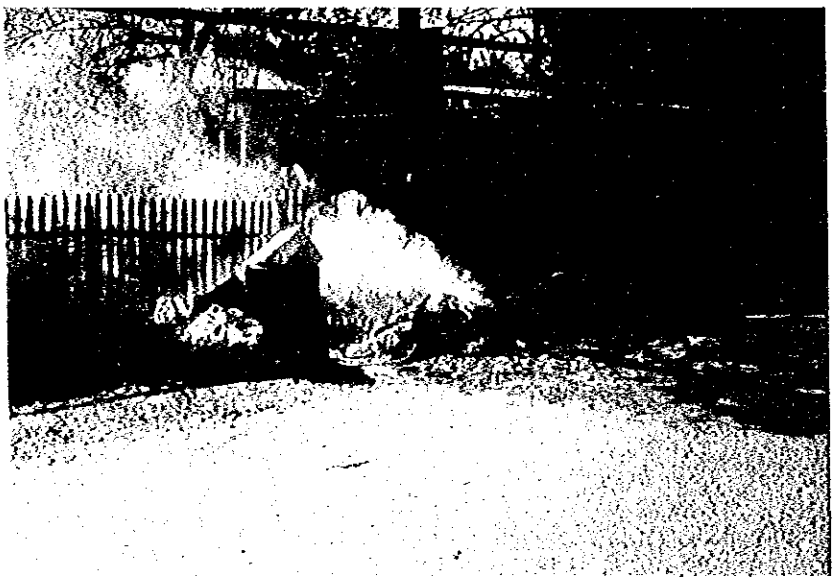
- Truck washing area
- Fuel pump station
- Office
- Passenger car space

CHAPTER 3 PRIORITY PROJECT

3.1 URGENT IMPROVEMENT AREAS

Figure D.3.1 shows a map of the urgent improvement areas. A survey was done in these areas and citizens were interviewed. Solid waste management is very poor here and the service is irregular. In some areas waste goes uncollected for about 2 weeks. Open dumping is observed in many areas. In other areas there is also burning of the waste by citizens. These scenes are shown in the following two photographs.





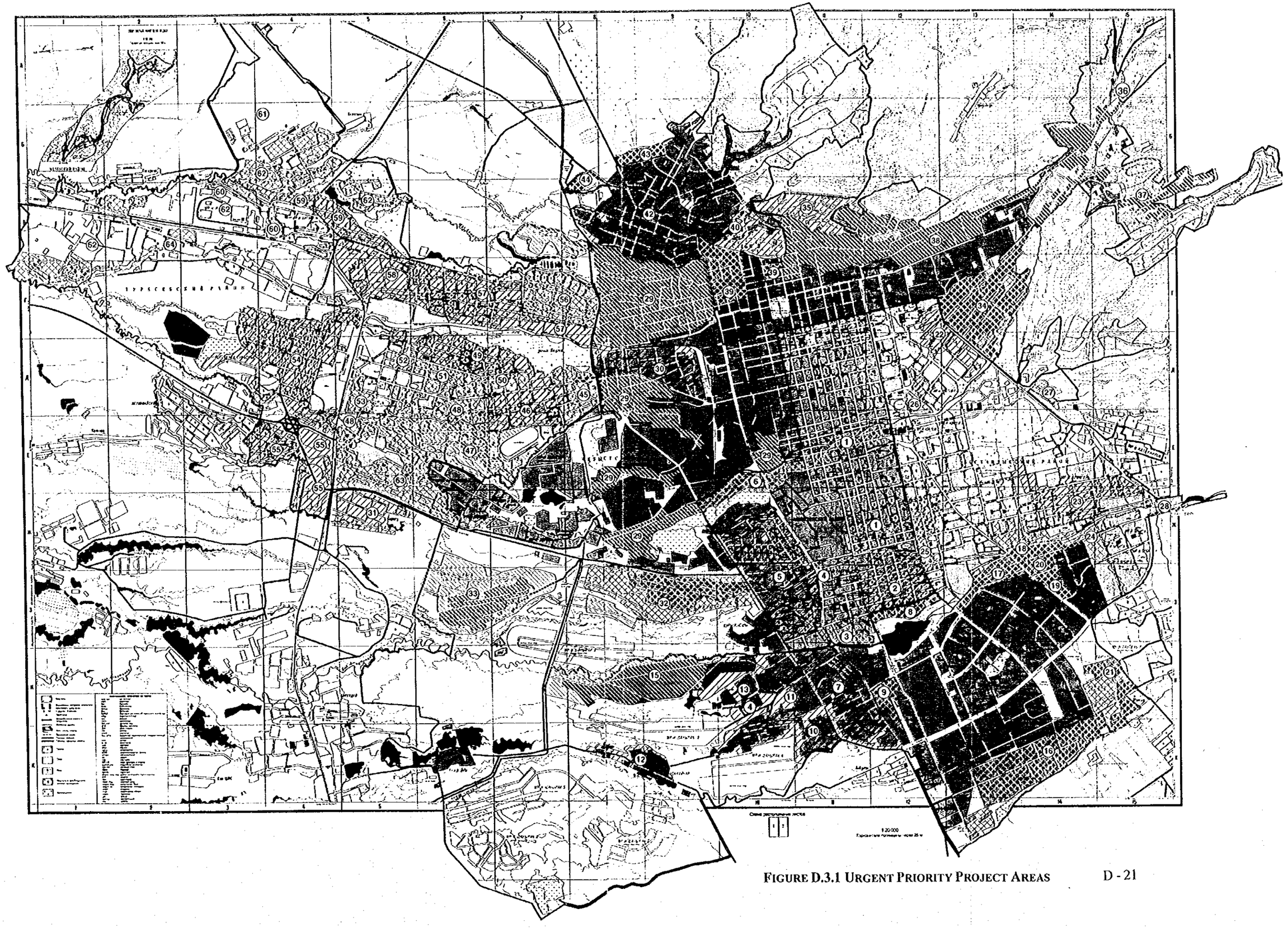


FIGURE D.3.1 URGENT PRIORITY PROJECT AREAS

Table D.3.1 shows the characteristics of the urgent areas. The data has been prepared based on the field survey made in Almaty city during the Summer, 1999. The total population in the urgent improvement areas is estimated to be about 419,000 persons. While most have water supply service (88% of the total) only 14% enjoy the central heating provided by the city. Also 13% have communal containers for waste near their homes while the rest discharge their waste in front of their houses.

An interview survey was also conducted at the urgent areas for 207 households. The results of the survey are shown in Table D.3.2. Residents were also asked about their perception of the existing problems and the improvements they require.

In terms of the most severe sanitation problems in their respective areas, the problem of sewage was considered very severe, followed by the problem of wastes left uncollected. Concerning the solid waste management in their areas the most severe concern was concerning low collection service frequency, waste scattering at the collection points and lastly irregular collection service.

The highest demand for service improvement was for waste collection service followed by sewage system. 65% of the residents expressed their willingness to separate the waste. Average charges paid by the residents for the present collection service was 57 KZT per month.

Table D.3.1 Characteristics of the Urgent Improvement Areas (1/2)

Table D.3.1 Characteristics of the Urgent Improvement Areas										
	Area	Res	House hold	Res/ HH	Heating				Water Supply available	SW ontainer station
					Solid fuel	Gas	Central	Other		
Almalinski	695	69,891	19811	3.5	26%	69%	1%	3%	100%	19%
1	57	2100	620	3.4	93%	0%	7%	0%	100%	100%
2	143	10750	3650	2.9	93%	0%	7%	0%	100%	100%
3	27	960	280	3.4	0%	100%	0%	0%	100%	0%
4	6	240	78	3.1	0%	100%	0%	0%	100%	100%
5	390	52516	14308	3.7	12%	83%	0%	4%	100%	0%
6	72	3325	875	3.8	0%	100%	0%	0%	100%	0%
Auezovski	468	85,650	21,390	4.0	32%	59%	3%	6%	80%	49%
7	44.8	6720	1680	4.0	1%	92%	5%	2%	88%	0%
8	9.04	904	226	4.0	78%	0%	2%	20%	71%	0%
9	3.9	392	98	4.0	84%	0%	4%	12%	91%	0%
10	14	2094	525	4.0	2%	92%	0%	5%	77%	0%
11	54	5400	1350	4.0	2%	96%	0%	2%	42%	0%
12	24	2400	600	4.0	67%	0%	0%	33%	30%	0%
13	32	4480	1120	4.0	2%	93%	2%	4%	60%	0%
14	24	240	60	4.0	8%	75%	0%	17%	100%	0%
15	104	20800	5200	4.0	92%	0%	0%	8%	100%	0%
16	109	33180	8196	4.0	0.5%	99%	0.7%	0%	77%	100%
17	9.5	2700	675	4.0	93%	0%	0%	7%	74%	100%
18	12	2800	700	4.0	94%	0%	0%	6%	86%	100%
19	0.18	480	160	3.0	0%	0%	90%	10%	100%	100%
20	0.09	180	80	2.3	0%	0%	74%	26%	100%	100%
21	27	2880	720	4.0	0%	0%	56%	44%	89%	100%
Bostandykski	103	43,945	9,794	4.5	37%	56%	3%	4%	93%	0%
22	20	4905	1092	4.5	37%	56%	0%	7%	93%	0%
23	26	16924	3776	4.5	37%	56%	3%	4%	93%	0%
24	9	2884	642	4.5	37%	56%	3%	4%	89%	0%
25	12	7692	1712	4.5	37%	56%	3%	3%	97%	0%
26	18	8655	1929	4.5	37%	56%	3%	4%	89%	0%
27	18	2885	643	4.5	37%	56%	3%	4%	97%	0%
Zhetysuski	41.3	45,541	12,468	3.7	23%	73%	2%	2%	84%	0%
28	16	2596	578	4.5	37%	56%	3%	4%	92%	0%
29	10	20865	6320	3.3	25%	72%	0%	3%	96%	0%
30	5	5280	1300	4.1	19%	62%	17%	3%	85%	0%
31	5	5100	1100	4.6	5%	91%	0%	5%	64%	0%
32	3	900	170	5.3	12%	88%	0%	0%	94%	0%
33	2.3	10800	3000	3.6	27%	73%	0%	0%	67%	0%
Medeuski	21.9	62,667	16,917	3.7	18%	84%	2%	-3%	76%	0%
34	2.3	9600	2200	4.4	27%	73%	0%	0%	26%	0%
35	3.2	7287	1817	4.0	5%	94%	0%	1%	9%	0%
36	0.8	180	60	3.0	100%	0%	0%	0%	100%	0%
37	0.6	1260	420	3.0	100%	0%	0%	0%	100%	0%
38	3.5	11820	2830	4.2	0%	93%	7%	0%	100%	0%
39	0.6	4683	1561	3.0	45%	48%	8%	0%	100%	0%
40	1.8	6888	2296	3.0	13%	87%	0%	0%	88%	0%
41	2.5	3204	1068	3.0	10%	90%	0%	0%	93%	0%
42	4.3	15750	4000	3.9	11%	89%	0%	0%	100%	0%
43	1.3	1800	600	3.0	100%	0%	0%	0%	100%	0%
44	1.0	195	65	3.0	49%	51%	0%	0%	100%	0%

Table D.3.1 Characteristics of the Urgent Improvement Areas (2/2)

	Area	Res	House hold	Res/ HH	Heating				Water Supply available	SW ontainer station
					Solid fuel	Gas	Central	Other		
Turksibski	70.1	110,663	21,191	5.2	6%	41%	46%	7%	92%	0%
45	1.2	3890	540	7.2	7%	81%	0%	11%	64%	0%
46	2.5	3700	600	6.2	6%	73%	0%	21%	81%	0%
47	4.8	3980	870	4.6	6%	77%	0%	17%	80%	0%
48	3.9	3300	826	4.0	8%	75%	0%	16%	87%	0%
49	5.2	3750	700	5.4	4%	80%	0%	16%	80%	0%
50	0.9	3100	800	3.9	0%	0%	100%	0%	100%	0%
51	4	3520	600	5.9	8%	83%	0%	9%	89%	0%
52	0.9	2700	470	5.7	0%	0%	100%	0%	100%	0%
53	2.7	12000	1600	7.5	0%	0%	100%	0%	100%	0%
54	6.8	6800	1520	4.5	15%	72%	0%	13%	90%	0%
55	2.1	3500	620	5.6	19%	53%	0%	27%	79%	0%
56	4.8	5800	1950	3.0	5%	85%	0%	11%	86%	0%
57	4.1	7420	1800	4.1	6%	87%	0%	7%	89%	0%
58	3.7	3900	880	4.4	23%	64%	0%	14%	44%	0%
59	3.2	3430	700	4.9	30%	59%	0%	11%	82%	0%
60	1.7	3100	559	5.5	16%	79%	0%	5%	87%	0%
61	4.2	1200	180	6.7	0%	0%	100%	0%	100%	0%
62	8.2	24000	3150	7.6	0%	0%	100%	0%	100%	0%
63	3	3573	826	4.3	5%	92%	0%	4%	75%	0%
64	2.2	8000	2000	4.0	0%	0%	100%	0%	100%	0%
Total	1,399	418,357	101,571	4.1	22%	61%	14%	4%	88%	13%

Table D.3.2 Urgent Priority Areas Interview Survey

Site	Sample number	House hold member	Services			Existing Solid Waste Management Issues												
			Potable water	Central heating	Drainag	Discharge in front of house	Self treatment			Discharge				Collection				
							Bury	Burn	Open dump	Daily	2d/wk	3d/wk	1d/wk	Daily	2d/wk	3d/wk	1d/wk	Irregular
2	4	12	100%	0%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
5	10	43	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	10%	0%	90%	0%
7	10	42	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
10	6	16	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
11	3	19	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
12	5	21	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	10	34	100%	100%	0%	0%	40%	40%	0%	0%	60%	0%	0%	0%	0%	0%	0%	0%
14	5	20	100%	40%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	15	66	27%	0%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%
22	7	19	100%	29%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
23	5	25	100%	60%	0%	60%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%
29	12	40	100%	75%	0%	42%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%
30	5	17	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	100%	0%	0%
31	5	19	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
33	10	42	60%	0%	0%	0%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
35	9	40	100%	100%	0%	0%	100%	100%	0%	0%	11%	0%	11%	0%	0%	0%	11%	0%
37	6	27	0%	0%	0%	100%	0%	0%	0%	0%	0%	100%	0%	0%	0%	67%	33%	0%
38	8	26	100%	100%	0%	75%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	88%	0%
40	10	43	100%	80%	0%	0%	20%	20%	0%	0%	0%	0%	80%	0%	0%	0%	80%	0%
41	5	13	100%	100%	0%	80%	20%	20%	0%	0%	0%	0%	80%	0%	0%	0%	80%	0%
42	10	40	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
45	5	20	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
46	5	20	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
47	5	14	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
49	5	15	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
54	6	19	100%	100%	0%	83%	17%	17%	0%	0%	0%	0%	83%	0%	0%	0%	83%	0%
55	3	9	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
56	4	13	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
57	3	10	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
58	3	13	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
59	4	19	100%	100%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
62	4	9	100%	0%	0%	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%
Total	207	785	87%	71%	0%	59%	21%	32%	7%	0%	3%	11%	58%	0%	0%	4%	64%	0%

3.2 COLLECTION TRUCKS TO BE USED

The following table shows the breakdown of the trucks to be used during the priority project period (from 2000 to 2005).

Table D.3.2 Collection trucks (2000 – 2005)

	Transfer	unit	2000	2001	2002	2003	2004	2005
A. WASTE AUTHORITY COLLECTED WASTE								
1) Direct haul		t/d (6d/wk)	334	342	0	0	0	0
2) Transfer station		t/d (6d/wk)	200	200	834	941	953	967
B. EXISTING TRUCKS USE								
1) KO 413	Direct	t/d	176	176	0	0	0	0
	Transfer	t/d	246	246	246	71	71	71
2) KO 415	Direct	t/d	65	65	0	0	0	0
	Transfer	t/d	88	88	88	88	88	88
3) KO 424	Direct	t/d	73	73	0	0	0	0
	Transfer	t/d	109	109	109	90	90	90
4) KO 431	Direct	t/d	74	74	0	0	0	0
	Transfer	t/d	104	104	104	104	104	104
5) GAZ dump truck	Direct	t/d	39	39	0	0	0	0
	Transfer	t/d	63	63	0	0	0	0
6) Zil dump truck	Direct	t/d	69	69	0	0	0	0
	Transfer	t/d	92	92	0	0	0	0
Sub-total B.	Direct	t/d	352	352	0	0	0	0
	Transfer	t/d	194	196	547	354	354	354
	Deficit	t/d	14	7	-287	-587	-600	-612
C. NEW TRUCKS								
	Direct	t/d			284	304	316	328
D. TRUCK NUMBER								
1) KO 413			53	53	53	15	15	15
2) KO 415			5	5	5	5	5	5
3) KO 424			21	21	21	17	17	17
4) KO 431			19	19	19	19	19	19
5) GAZ dump truck			24	24	24	0	0	0
6) ZIL dump truck			44	44	44	0	0	0
7) Compactor 8m3					32	32	32	32
8) Compactor 12m3						8	8	8
9) Arm roll						27	27	27
TOTAL			166	166	198	123	123	123

Figure D.3.2 shows the distribution of waste to be collected annually from 2000 to 2005 into the following categories:

- By old trucks and new trucks
- By transfer haul and by direct haul

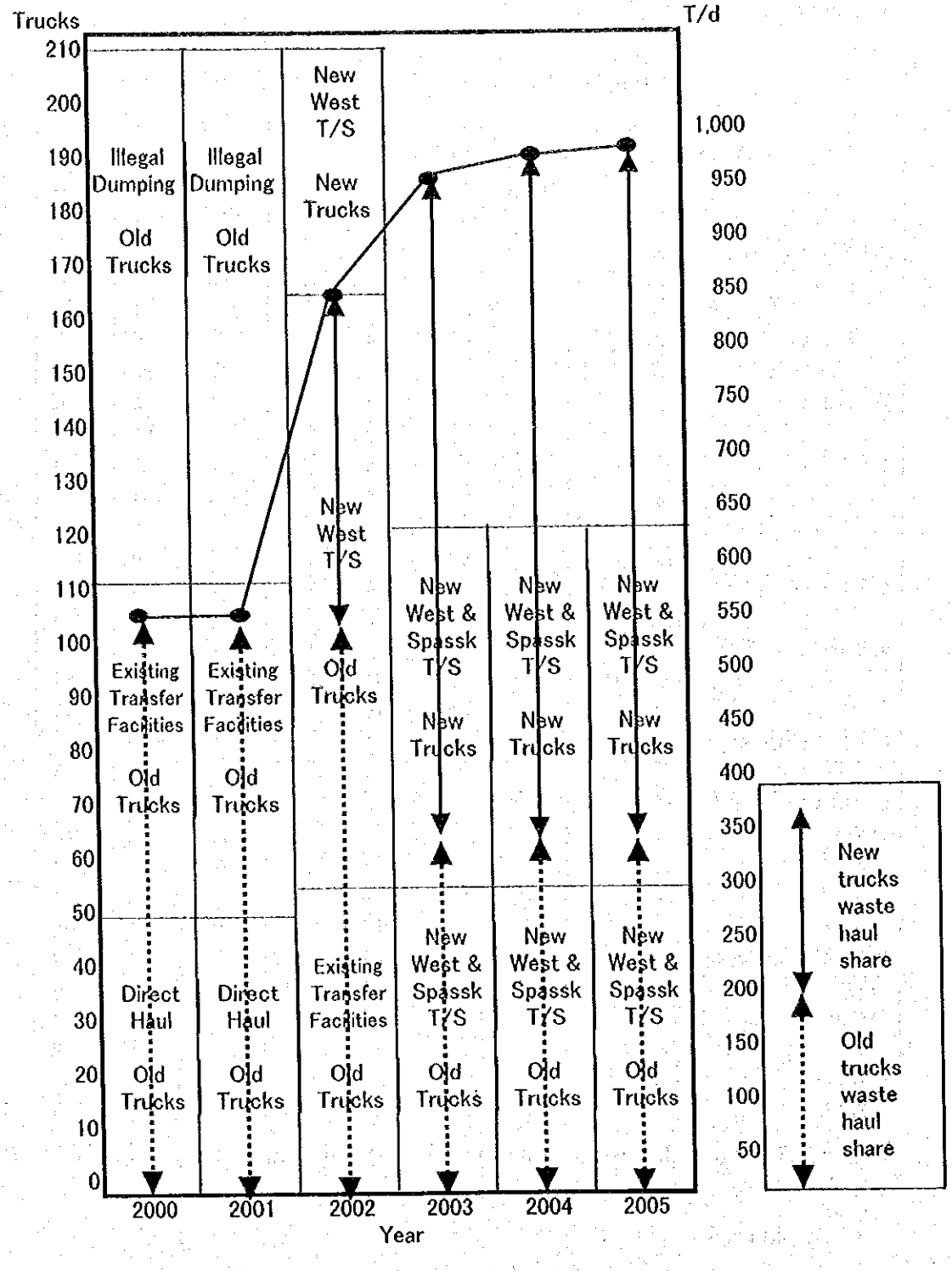


Figure D.3.1 Collected Waste Amount Distribution

3.3 TIME AND MOTION SURVEY

This survey was implemented during this study and provided significant information on the existing operation conditions. It is recommended that from time to time the Waste Authority inspectors conduct this survey to monitor the collection work and for the private companies to check the efficiency of the truck utilization.

This survey has been discussed in detail in the report titled "Improvement of Solid Waste Management in Developing Countries", by Dr. K. Sakurai and published by JICA in July 1990. The contents are summarized hereafter.

(1) Objectives of the Survey

- Efficiency of collection equipment utilization (loading capacities, working hours)
- Efficiency of the collection crews (waste collected per crew member)
- Appropriateness of the collection route
- Appropriateness of collection time schedule (effect of rush hours on collection times on certain routes)
- Suitability of collection points, communal containers and individual bins used by the citizens
- Crew behavior (crew internal cooperation, wasting time on other activities such s recycling, etc.)
- Extent of community participation (respecting discharge regulations)

(2) Requirements for the Survey

- A clear map of the survey collection routes
- Population (or household number) served on the collection route
- Digital watch
- Truck scale
- Odometer in working condition
- Necessary form for recording

(3) Execution of the Survey

In principle the surveyor will be given a form to fill out during the survey. The surveyor shall either ride in the collection truck beside the driver (the truck odometer must be in working condition) or use his own vehicle and follow the truck. The following information will be recorded.

- Time (garage departure, 1st trip collection zone arrival, collection points arrival and departures, disposal site/transfer station arrival and departure, etc.)
- Number of bins collected at each stopping point and average sizes
- Weight of waste
- Odometer readings (at same locations as for time recording)
- Prepare a map showing the route

(4) Analysis of the Results

- Working hours effective utilization
- Loading capacity effective utilization
- Individual containers study
- Route and road study
- Crew behavior study
- User cooperation study

3.4 COLLECTION ROUTES

Once the suitable collection system for a certain area has been established the collection route in that area should be designed. The design of the collection route is more or less a common sense approach and depends to a great deal on an understanding of the area conditions. It is recommended that routes be designed on maps by the engineers and the drivers and then tried out actually on site. As necessary the drivers may make some changes which should be reported to the engineer. The final route should then be plotted on the map.

Some of the general considerations in the design of the routes are as follows:

(1) The collection system in the area must be defined, such as determination of collection points and service frequencies.

(2) The routes should be planned so that the starting and terminating points end near arterial streets, and topographical or physical barriers may be used to define the route boundaries.

(3) In hilly areas, routes should start at the top of the grade and proceed downwards as the truck becomes loaded.

(4) The last collection point served at the end of the route should be nearest to the disposal site.

(5) Wastes generated at traffic congested areas should be collected as early in the day as possible.

CHAPTER 4 UNIT COSTS FOR COLLECTION PLAN CALCULATIONS

4.1 PERSONNEL COSTS

The personnel costs used in the estimation of collection and transport operation and maintenance costs are shown in the following table.

No.	Category	Unit cost (KZT/month)
1	Supervisor (1 supervisor per ten trucks)	18,000
2	Driver	12,000
3	Worker	10,000
	- 3 persons / compactor in IH areas	30,000
	- 2 persons/ compactor in BH areas	20,000
	- 1 person/ arm roll	10,000
	- 1 person/ KO side loader	10,000

All the above salaries were for an 8 hour shift. However in the calculation consideration was given for a 10 hour working day and therefore salaries were adjusted to include overtime.

4.2 EQUIPMENT COSTS

The costs of equipment used in the master plan and feasibility study cost estimations are given in the following table.

No.	Equipment	Unit cost (USD/unit)
(1)	Collection Equipment	
1	Compactor 8 m3	77,622
2	Compactor 12 m3	100,660
3	Arm roll 6m3	71,220
4	Container 6m3	5,700
5	Container 1.1m3	300
6	Container KO, 0.7,3	100
7	Side loader KO	22,000
(2)	Transfer Equipment	
8	Tractor-trailer (semi-trailer)	172,010
9	Wheel loader (for transfer station)	132,860
10	Ash transfer truck (used in cost estimate of Alternative 4 of the M/P)	68,000

4.3 OTHER UNIT COSTS

The fuel costs were calculated based on the estimates of the distances traveled daily and the fuel consumption of 100 kilometers per 40 liters. Unit costs of fuel were:

- Gasoline 40 KZT/liter (used by side loader trucks)
- Diesel oil 25 KZT/liter (used by all western made trucks)

A miscellaneous cost was estimated to cover such costs as tools used by the workers during the collection work, crew uniforms, repairs at container platforms, etc. This cast was estimated to be 25% of the sum of (personnel salaries + fuel + maintenance and repairs).