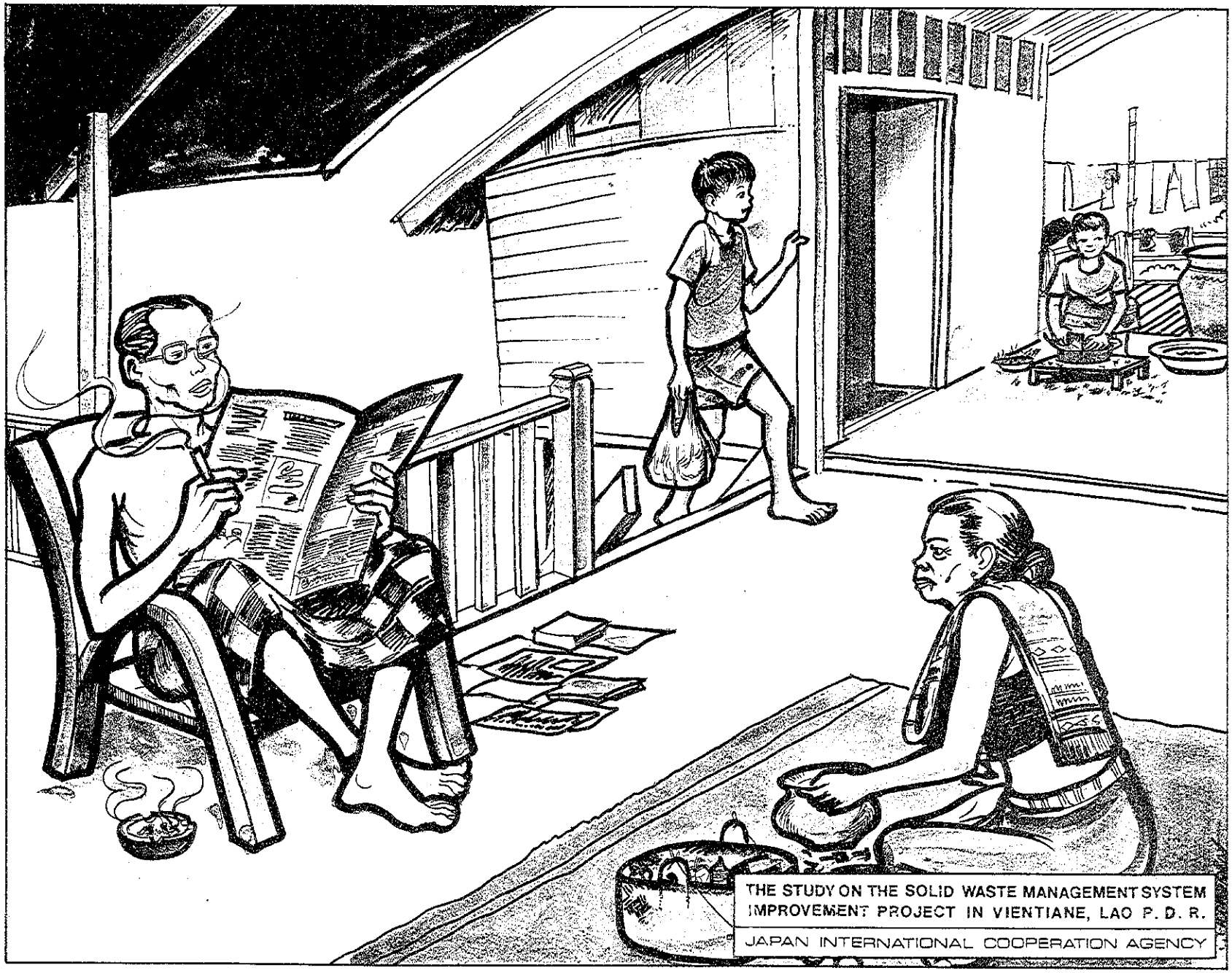
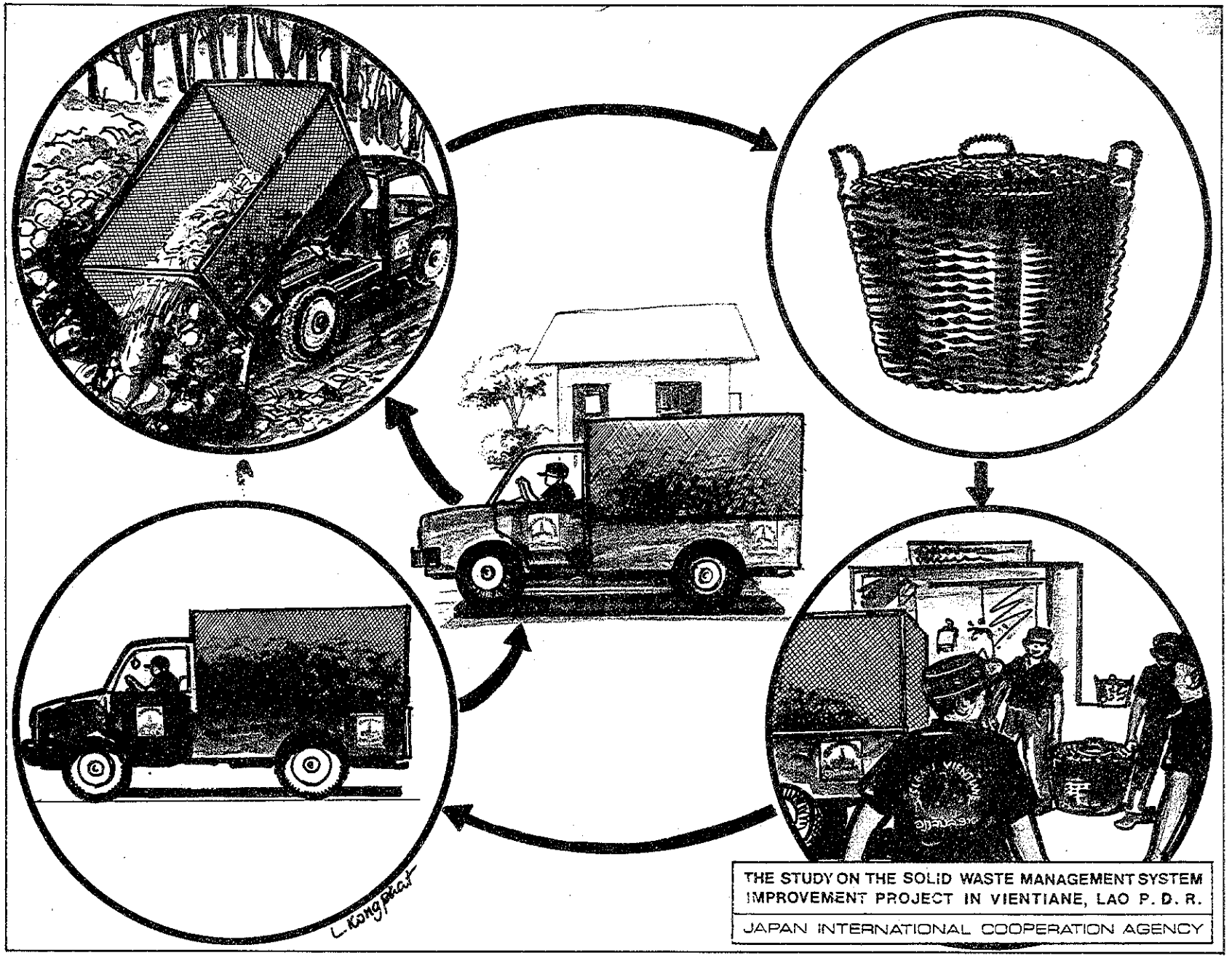
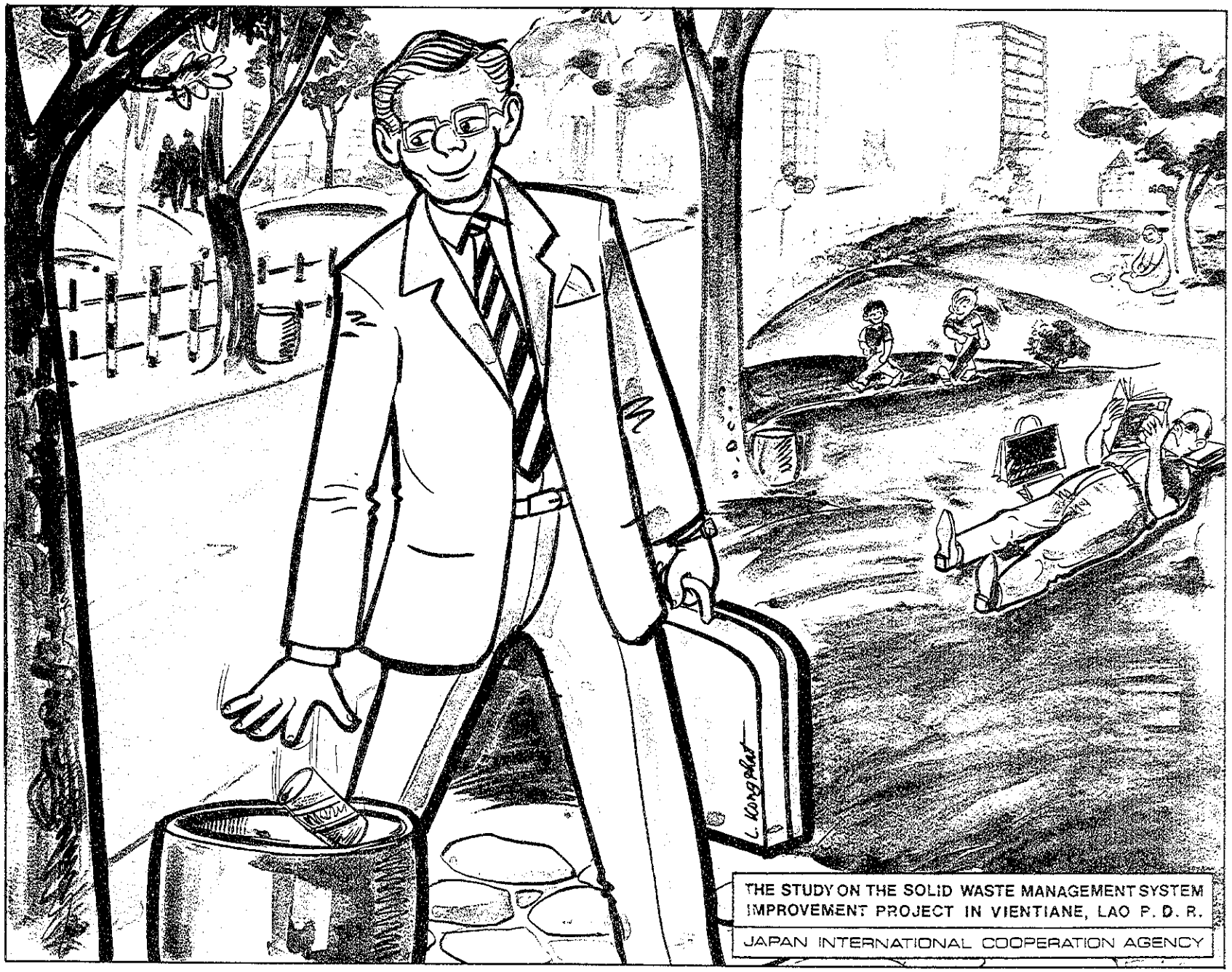


The Drawing Board prepared by the Study Team for Education Program



The Drawing Board prepared by the Study Team for Education Program



The Drawing Board prepared by the Study Team for Education Program

3) Public Instructions and Education by Municipal Government

Public instructions and education to be given by municipal government should be the following that would help the municipal government achieve its specific improvement targets with respect to waste collection and disposal.

- days of waste discharge (to keep waste inside the house until the collection day);
- discharge time;
- discharge method and place;
- use standard bins if required; and
- separation of waste if required.

Public instruction and education can be most effective if they are given in the form of an organized campaign.

N.3 Estimation of Project Cost

N.3.1 Investment Cost

The investment cost was estimated based on the 1992 prices by adding the cost of each items. The project cost was basically estimated as follows:

- Foreign portion was estimated on the basis of CIF cost, taking into consideration the import tax (5%) and turnover tax (3%).

- Changing rate used was:
  1 US$ = 129 yen = 729 kips

- The import tax, turnover tax and a part of the labour cost of unskilled workers were excluded from the economic cost estimates.

- Land cost was excluded from the financial cost estimate, as the land is owned by Vientiane Municipality.

1) Collection and Haulage

Investment cost for collection and haulage covers the purchasing of the collection vehicles and containers required for the Municipality's service in 1995. Financial and economic costs for collection and haulage are shown in Table N.3-1.

Table. N.3-1 Investment Cost for Collection and Haulage

(million Kips)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
Collection Equipment				
Dump Truck (DT)	479.3	0.0	479.3	443.8
Detachiable Container Truck (DCT)	140.9	0.0	140.9	130.5
Container	177.0	0.0	177.0	163.9
Spare Parts				
for DT	48.0	0.0	48.0	44.4
for DCT	14.1	0.0	14.1	13.1
Total	859.3	0.0	859.3	795.7

2) Cleansing

Investment cost for cleansing services such as road sweeping, grass cutting and drain cleansing, covers the purchasing of containers, water trucks, small dump trucks, wheel loaders, grass cutters, etc.. Financial and economic cost for cleansing services are shown in Table N.3-2.

Table N.3-2 Investment Cost for Cleansing (million Kips)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
Cleansing Equipment				
Water Truck	87.3	0.0	87.3	80.8
Small Dump Truck	52.4	0.0	52.4	48.5
Wheel Loader	60.4	0.0	60.4	55.9
Pick-up	15.2	0.0	15.2	14.1
Grass Cutter	6.7	0.0	6.7	6.2
Container	67.2	0.0	67.2	62.2
Spare Parts				
for Water Truck	8.7	0.0	8.7	8.1
for Dump Truck	5.3	0.0	5.3	4.9
for Wheel Loader	6.0	0.0	6.0	5.6
for Pick-up	1.5	0.0	1.5	1.4
for Grass Cutter	0.6	0.0	0.6	0.6
Total	311.3	0.0	311.3	288.3

3) Disposal (Level 2)

Investment cost for the disposal site consists of the construction and equipment purchasing costs. Financial and economic costs are shown in Table N.3-3.

Table N.3-3 Investment for Disposal Site

(million Kips)

	Financial Cost			Economic
	Foreign	Local	Total	Cost
Site Development				
Clearing & Site Preparation	117.7	117.6	235.3	210.1
Main Facility				
Enclosing Structure	29.4	29.4	58.8	52.5
Drainage System	18.4	18.4	36.8	32.9
Access	4.4	4.3	8.7	7.8
Building & Accesaries	8.3	5.5	13.8	12.8
Environmental Protection Facilities	1.0	1.0	2.0	1.8
Equipment				
Landfill Equipment				
Bulldozer	137.4	0.0	137.4	127.2
Hydraulic Excavator	92.8	0.0	92.8	85.9
Dump Truck	44.0	0.0	44.0	40.7
Spare Parts	27.4	0.0	27.4	25.4
Total	480.8	176.2	657.0	597.1

4) Maintenance Shop

Investment cost for the maintenance shop covers the purchasing of maintenance equipment, site development and construction of buildings. Financial and economic costs are shown in Table N.3-4.

Table N.3-4 Investment Cost for Maintenance Shop

(million Kips)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
Construction				
Site Development	5.1	5.0	10.1	9.2
Buildings				
Main Building	63.9	42.6	106.5	98.6
Inspection Pit	7.5	5.0	12.5	11.6
Storage for Washing Equipment	0.6	0.4	1.0	0.9
Maintenence Equipment	122.0	0.0	122.0	113.0
Total	199.1	53.0	252.1	233.3

5) Fee Collection

Investment cost for fee collection covers the purchasing of motorcycles. The fee collection activities shall greatly influence the success of SWM. Therefore, the usage of motorcycles are expected to extend the service.

Table N.3-5 Investment Cost for Fee Collection

(million Kips)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
Equipment Mortorcycle	32.9	0.0	32.9	30.5
Spare Parts for Motorcycle	3.3	0.0	3.3	3.1
Total	36.2	0.0	36.2	33.6

6) Total Investment Cost

Total investment cost amounts to 2,450.9 million kips including engineering fees, physical contigency and price contingency as shown in Table N.3-6.

Table N.3-6 Total Investment Cost

(million Kips)

	Financial Cost			Economic Cost
	Foreign	Local	Total	
Collection Improvement	859.3	0.0	859.3	795.7
Cleansing	311.3	0.0	311.3	288.3
Final Disposal	480.8	176.2	657.0	597.1
Maintenanceshop	199.1	53.0	252.1	233.3
Fee Collection	36.2	0.0	36.2	33.6
Sub-Total	1,886.7	229.2	2,115.9	1,948.5
Engineering Fee 1)	188.7	22.9	211.6	
Physical Contingency 2)	25.6	22.9	48.5	
Price Contingency 3)	56.6	18.3	74.9	
Total	2,157.6	293.3	2,450.9	1,948.5

1) 10% investment cost

2) 10% investment cost

3) 3% investment cost and 8% for local to investment cost

Note:

* Engineering fee is equivalent to 10% of investment cost.
* Physical contingency is equivalent to 10% of construction cost.
* Price contingency for foreign and local costs is equivalent to 3% and 8% of investment cost respectively.
* The construction period of the disposal site and maintenance shop is assumed to take one year (1994) and the supply of vehicles and equipment is also assumed to take the same.

Above mentioned investment costs are necessary to set up the Phase I project. As mentioned in the Basic Plan, it is important to gradually increase the supply of collection vehicles to achieve the 100% target collection rate for 2000. As for the disposal site, extension works will be required after 1998.

The financial analysis of the above is shown in N.4.4 and the financial plan is in N.5.2.

N.3.2 Operation Cost

Operation cost consists of the depreciation cost and the operation/maintenance cost which covers costs for fuel, personnel, construction and management, etc.

The depreciation cost was calculated by dividing facility and equipment costs by their life spans, taking the residual value into consideration. The maintenance cost was calculated by multiplying the construction/procurement costs by specific rates. The fuel cost was calculated on the basis of a standard unit of consumption.

Personnel cost was calculated on the basis of the Table N.3-7. Economic cost was estimated to consider the import tax for fuel and spare parts, the turnover tax and personnel cost of unskilled labourers.

Table N.3-7 Number of Personnel for the USD

Sub-pro 10	Number of person					
	1995	1996	1997	1998	1999	2000
Director	1	1	1	1	1	1
Deputy Director	1	1	1	2	2	2
Reserch & Development						
Manager	1	1	1	1	1	1
Engineer				1	1	1
Technician	1	1	1	2	2	2
Administration						
Manager	1	1	1	1	1	1
Sub Manager	1	1	1	2	2	2
Clerk	6	6	6	8	8	8
Fee Collector	18	21	24	28	31	34
Collection						
Manager	1	1	1	1	1	1
Engineer	1	1	1	1	1	1
Supervisor	3	3	3	4	4	4
Driver	17	21	25	30	34	38
Worker	59	75	91	111	127	143
Cleansing						
Manager	1	1	1	1	1	1
Supervisor	2	2	2	3	3	3
Mechanic	1	1	1	1	1	1
Driver	6	6	6	8	8	8
Worker	29	29	29	32	32	32
Disposal						
Manager	1	1	1	1	1	1
Engineer				1	1	1
Supervisor				1	1	1
Mechanic	2	2	2	2	2	2
Clerk	1	1	1	1	1	1
Driver	1	1	1	2	2	2
Worker	1	1	1	2	2	2
Campaign & Other						
Manager	1	1	1	1	1	1
Supervisor	1	1	1	1	1	1
Clerk	2	2	2	4	4	4
Workshop						
Manager	1	1	1	1	1	1
Engineer				1	1	1
Supervisor	1	1	1	2	2	2
Mechanic	4	4	4	8	8	8
Clerk	4	4	4	4	4	4
Sub Total *	170	193	216	270	293	316
Night Soil	27	31	35	40	45	50
Total *	197	224	251	310	338	366

1) Collection and Haulage

The annual operation cost of collection and haulage will increase according to collection amount of waste.

Table N.3-8 Annual Operation Cost of Collection and Haulage

(million Kips)

	Financial Cost			Economic Price
	1995	1996	1997	1995
Depreciation				
Vehicle	87.7	107.1	126.5	
Container	35.4	35.4	35.4	
Sub-Total	123.1	142.5	161.9	
Maintenance Cost	22.5	26.6	30.7	21.4
Fuel & Others	66.1	73.6	81.0	56.2
Personnel Expenses	18.5	22.9	27.3	14.6
Total*	230.2	265.5	300.9	

2) Cleansing

The annual operation cost of road sweeping, grass cutting and drain cleansing services was considered to remain the same.

Table N.3-9 Annual Operation Cost of Cleansing

(million Kips)

	Financial Cost			Economic Price
	1995	1996	1997	1995
Depreciation				
Vehicle	31.9	31.9	31.9	
Container	13.4	13.4	13.4	
Sub-Total	45.4	45.4	45.4	
Maintenance Cost	7.1	7.5	7.9	6.7
Fuel & Others	64.8	64.8	64.8	55.1
Personnel Expenses	9.0	9.0	9.0	7.1
Total	126.3	126.7	127.1	69.0

Maintenance cost will be half of the general cost to avoid giving importance to the annual workshop cost.

3) Disposal Site

The annual operation cost of the disposal site before 1998 was calculated based on the disposal amount of waste in that year. Fuel and other costs were excluded from the calculation. On the other hand, the annual operation cost of the disposal site after 1999 was calculated based on the disposal amount of waste estimated for 2005.

Table N3.10 Operation Cost of Disposal Site

(million Kips)

	Financial Cost			Economic Price
	1995	1996	1997	1995
Depreciation				
Civil work & Building	99.7	99.7	99.7	
Equipment(Vehicle)	38.8	38.8	38.8	
Sub-Total	102.6	102.6	102.6	
Maintenance Cost	5.3	6.5	7.7	5.0
Fuel & Others	12.7	15.5	18.4	10.8
Personnel Expenses	1.7	1.7	1.7	1.6
Total	122.3	126.4	130.4	17.5

4) Maintenance Shop

The slight increase in utility expenses resulting from the increase in the number of required vehicles might be disregarded in the calculation of the annual costs of the maintenance shop.

Table N.3-11 Operation Cost of Maintenance Shop

(million Kips)

	Financial Cost			Economic Price
	1995	1996	1997	1995
Depreciation				
Civil work & Building	4.3	4.3	4.3	
Machinery	24.4	24.4	24.4	
Sub-Total	28.7	18.7	28.7	
Personnel Expenses	3.0	3.0	3.0	2.9
Total	31.7	31.7	31.7	2.9

5) Others

This section covers the administrative overall cost which includes the fee collection services (see Table N.3-12).

Table N.3-12 Administrative Cost

(million Kips)

	Financial Cost			Economic Price
	1995	1996	1997	1995
Depreciation				
Motorcycle	4.7	5.4	6.2	
Maintenance Cost	1.0	1.2	1.4	1.0
Fuel & Others	3.5	4.1	4.7	3.0
Personnel Expenses	9.2	9.8	10.5	8.0
Total	18.3	20.6	22.8	11.9

6) Total Operation Cost

The total operation cost in 1995 is shown below in Table N.3-13, based on the above estimation.

Table N.3-13 Total Operation Cost in 1995

(million Kips)

	Oepreciation Cost	Maintenance Cost	Fuels & Others	Personnel Expenses
Collection	123.1	22.5	66.1	18.5
Cleansing	45.4	7.1	64.8	9.0
Final Disposal	102.6	5.3	12.7	1.7
Maintenanceshop	28.7			3.0
Management	4.7	1.0	3.5	9.2
Total	304.5	35.9	147.1	41.3

N.3.3 Project Cost

The details of the collection and cleansing services project cost and disposal site project cost are shown in Table N.3-14 and N.3-15, respectively.

Table N.3-14 Collection and Cleansing Services Project Cost in 1995

Items	Unit	Unit Price (1000kip)	Quantity	Amount (1000kip)
1. For Cleansing Services				1,117,576
1.1 Equipment				1,036,527
a. Collection Equipment				768,773
i. Dump Truck(DT)	Unit	31,703	14	443,842
ii. Detachable Container Truck(DCT)	Unit	43,514	3	130,542
iii. Container	Unit	5,651	29	163,879
iv. Motorcycle	Unit	1,695	18	30,510
b. Cleansing Equipment				267,754
i. Container	Unit	5,651	11	62,161
ii. Water Truck	Unit	40,406	2	80,812
iii. Small Dump Truck	Unit	16,162	3	48,486
iv. Wheel Loader	Unit	55,947	1	55,947
v. Grass Cutter	Unit	622	10	6,220
vi. Pick-up	Unit	14,128	1	14,128
1.2 Spare Parts				81,049
a. For Collection Equipment				60,489
i. Dump Truck(DT)	LS	44,384	1	44,384
ii. Detachable Container Truck(DCT)	LS	13,054	1	13,054
iv. Motorcycle	LS	3,051	1	3,051
b. For Cleansing Equipment				20,559
i. Water Truck	LS	8,081	1	8,081
ii. Small Dump Truck	LS	4,849	1	4,849
iii. Wheel Loader	LS	5,595	1	5,595
iv. Grass Cutter	LS	622	1	622
v. Pick-up	LS	1,413	1	1,413
2. Maintenance Shop				242,870
2.1 Site Development				9,870
i. Embankment	m3	6	1,000	6,000
ii. Approach Road	m	43	90	3,870
2.2 Buildings				120,000
i. Main Building(448 m²)	LS	106,500	1	106,500
ii. Inspection Pit	LS	12,500	1	12,500
iii. Storage for Washing Equipment	LS	1,000	1	1,000
2.3 Maintenance Equipment				113,000
i. For General Maintenance & Repair	LS			0
ii. For Tire Shop	LS			0
iii. For Tool and Spare Parts Storage	LS			0
iv. For Office Work	LS			0
v. For Inspection Pits	LS			0
vi. For Field Storage	LS			0
Total (A + B)				1,360,446

Note ;

*1 : Project cost was estimated based on the market price of February, 1992.

*2 : Costs of vehicles and equipment exclude the import tax and turn over tax.

Table N.3-15 Disposal Site Project Cost

I T E M S	Unit	Unit Price 1000 Kips	Quantity	Amount 1000 Kips	R E M A R K S
1. Site Developement Works				348,435	
1.1 Clearing & Site Preparation				235,235	
i. Clearing Plants	ha	750	4.0	3,000	
ii. Cleaning-up Waste Disposed	1000 m3	380	70.0	26,600	
iii. Soil Excavation	1000 m3	1,800	77.0	138,600	
iv. Soil Cover for Landfill Area by 1994	1000 m3	1,950	23.3	45,435	
v. Soil Stock	1000 m3	900	24.0	21,600	
1.2 Main Facilities				98,110	
a. Enclosing Structure				55,680	
i. Enclosing Bund	m	32	1680.0	53,760	
ii. Divider	m	12	160.0	1,920	
b. Drainage System				33,640	
i. Surrounding Drain	m	10	1370.0	13,700	
ii. Side Ditch for Reclaimed Area	m	4	920.0	3,680	
iii. Cross Drain	m	35	16.0	560	
iv. Vertical Drain	m	30	30.0	900	
v. Pipe Culvert	m	370	40.0	14,800	
c. Access				8,790	
i. Approach Road	m	70	80.0	5,600	
ii. On-Site Road	m	22	145.0	3,190	
1.3 Building and Accessories				13,100	
i. Site Office	m2	270	30.0	8,100	
ii. Fence	m	5	1000.0	5,000	Gate, Fence, Lights & etc.
1.4 Environment Protection Facilities				1,990	
i. Buffer Zone	m	2	620.0	1,240	
ii. Gas Removal Facilities	Nos	150	5.0	750	
2. Equipment				279,111	
a. Landfill Equipment				253,737	
i. Bulldozer	Unit	127,151	1.0	127,151	
ii. Hydraulic Excavator	Unit	85,898	1.0	85,898	
iii. Dump Truck	Unit	40,688	1.0	40,688	
b. Spare Parts				25,374	
i. For Bulldozer	LS	12,715	1.0	12,715	
ii. For Hydraulic Excavator	LS	8,590	1.0	8,590	
iii. For Dump Truck	LS	4,069	1.0	4,069	

Note ;

*1 : Project cost was estimated based on the market price of February, 1992.

*2 : Costs of vehicles and equipment exclude the import tax and turn over tax.

*3 : Construction cost of the water supply for the areal residents is not included in the project cost, as it shall be done by Nampapa Lao.

N.4 Project Evaluation

N.4.1 Technical Evaluation

1) Improvement of Collection and Cleansing Works

From technical view point there is no problem in the extension of collection service and establishment of an efficient and reliable service by curb and bell collection system, and establishment of public cooperation for clean-up roads, drains and public areas. These systems have been implemented smoothly as the pilot project in the collection experimental area and have been accepted by the residents, even though residents complained about these systems especially on use of standard bamboo baskets at the initial stage.

Therefore, it is feasible to extend collection services to half population of Vientiane urban area by 1995 as proposed.

The collection experiment in the 3 Bans in Pasak shows that these systems have following benefits:

a. Bell and curb collection systems were applied in the experiment. Due to regular and designated collection services to residences and shops in the area, the residents conceded in bringing their waste to collection points. Consequently, an effective collection work was achieved as proven by the T & M study. It is also proven that the proposed collection system in the Basic Plan should be implemented for the method of the extension of the collection service to the whole Vientiane urban area.

b. As for the cleaning-up of roads, drains and public areas through public cooperation, a cleansing day was proposed and implemented in each Ban. Although the result of the cleansing work by the residents was not satisfactory. It proves that the sanitary environment of the experimental areas can be improved step by step through the further efforts such as the implementation of public campaigns and education, in order to achieve public cooperation in its cleansing services.

2) Use of Dump Truck

It is proposed that dump trucks with 10 cu.m body be used for domestic and commercial wastes collection also in future. It will not cause any problem to DCTC because DCTC has been using the vehicles of this type and size already.

By the law in Vientiane Municipality, waste loaded in the collection vehicles should be covered in order to avoid scattering. Although open dump trucks are popular in the Study area, a close dump truck is planned. Thus, the use of close dump truck will improve the collection works because it does not require cover the waste loaded.

3) Construction of Level 2 Sanitary Disposal Site at KM 18-DS

From technical view point, level 2 sanitary disposal site which has daily soil cover to improve the landfill operation does not have difficulty in construction and operation.

N.4.2 Environmental Evaluation

1) Introduction

As part of the solid waste management Basic Plan for Vientiane urban area, a site was identified for the development of sanitary landfill that would receive the solid waste of Vientiane urban area.

The site was selected from a list of 3 potential sites based on a set of criteria that included environmental, economic, transactional and technical considerations.

The KM 18 site is located at 18 km from Vientiane of the Route 13. The area proposed is presently used as the open dump site for Vientiane Municipality and the population density in the surrounding is low.

The sanitary landfill will be constructed in two phases. Because of financial considerations, the level of landfill development and operation will be designed at level 2 in the first phase.

The level of landfill development and operation proposed for the second phase will be at level 3, where the leachate from the sanitary landfill will be collected.

2) Existing Environment

a. Physico-chemical environment

The air quality in the area does not seem to be good due to the open fire at the site.

The area is relatively quiet, except for the collection vehicles and little noise generated by human activities as the population density is low.

b. Biological environment

The KM 18 site consists of sparse woods, paddy field and dumping areas. The sparse woods seem to be very poor in plant and animal species.

c. Socio-economic environment

The two villages nearby are Ban Lak Sippet and Ban Phokham with a total population of about 1,000 persons. These are predominantly Laotian and the main occupations are related to farming. The household income for Phokham is estimated at 40,000 kips per month or 6,800 kips mean per capita income.

The surrounding land use is mainly agriculture with paddy cultivation in the alluvial plains.

3) Environmental Impacts

a. Construction phase

i. noise

In some cases the noise level may be higher than the WHO's standard of 55 db (A), but no adverse effect in daily life is expected, because the construction period is not too long at the same place and works shift.

ii. dust

Adverse impact from dust would not be significant in comparison with the present crude open dumping.

iii. traffic volume

Increase of traffic volume in relation to the construction will not be expected.

b. Operational phase

i. leachate

Comparing with the present crude open dumping, the landfill operation will be carried out in the limited area by the construction of enclosing bunds and dividers. This will result the reduction of leachate generation. Accordingly, the adverse effect by leachate will be reduced in comparison with the present operation.

Although the permeabilities of the subsoils of the three candidate disposal sites are less than 10^{-5} cm/sec., impact on groundwater pollution will be fair. It is, therefore, not recommended to use groundwater for drinking if the site would be used as a disposal site. Consequently, the Municipality or Nampapa Lao shall provide potable water to the surrounding area.

ii. noise

Of the sanitary landfill equipment, the major noise sources are bulldozers. However, more than 55 db (A) of noise is expected to be attenuated because of a two-meter high bund around the disposal area, and areas around the site would not be exposed to the same noise level for a long time because the landfill area will shift.

iii. dust and odor

The generation of dust can be controlled with the proposed plan in which water sprinkler truck will stand ready for water sprinkling whenever necessary.

The proposed sanitary landfill in which soil covering will be conducted every day can minimize the generation of odor.

iv. air pollution

Though the most serious pollutant derived from vehicle exhaust gas in Vientiane is carbon monoxide (CO), estimated concentrations of CO are very low.

c. Plant and animal communities

There seems to be no adverse effects on the plant and animal communities, because the site has been used for more than 20 years as the only open dumping site in Vientiane.

d. Human settlements

There will be no additional adverse effects on the surrounding human settlements other than present effects, because a sanitary landfill operation will mitigate various adverse effects occurred at present. However, the Municipality or Nampapa Lao shall provide potable water to the surrounding settlements in order to avoid the use of groundwater for drinking purpose which may be contaminated by the landfill operation.

4) Mitigating and Abatement Measures

To reduce the impact of the leachate, the generation of it will be limited by the construction of enclosing bund and divider.

To avoid problems to be occurred by the contamination of the groundwater, potable water will be supplied by the Municipality or Nampapa Lao to the surrounding residences.

There should be regular monitoring on the area surrounding the discharge point as well as seepage into the groundwater around the disposal site.

To reduce the noise levels during the operation of the site, there should be an earth bund to attenuate the noise levels as well as a buffer zone between the site and residences.

To minimize the odor problems, the sanitary landfill must be properly maintained.

There should also be green belt of trees and other plants between the disposal site and public areas for aesthetic reasons.

5) Residual Impacts

Despite above measures, some residual impact on the surrounding area would nevertheless remain.

In order to examine impacts on surrounding environment by landfill operation, monitoring systems should be introduced.

It would also be crucial to educate vehicle drivers to be careful along rural roads. Courteous behavior in these areas can go a long way to mitigate prejudice by the local residents on solid waste disposal.

Another important feature of the overall effort is to ensure that potable water should be supplied to the surrounding residents in order to avoid the problems occurred by the groundwater contamination.

N.4.3 Social Evaluation

1) Impact on Public Health

a. Present situation

The urban and surrounding area of the Vientiane Municipality has faced serious environmental degradation due to the generation of solid waste with increasing complexity. Solid waste collection and disposal has become a social and public health problem of great magnitude, and this is evident in the infant mortality rate (IMR) and mortality rate of children from one to four years old (U5MR) in the country. The IMR and U5MR in the country is estimated at 118 and 193 per 1,000 live birth respectively.

Comparing the above figures with neighboring countries as shown in Table N.4-1, the IMR and U5MR of Lao is located in the worst position.

Table N.4-1 Mortality of Lao P.D.R. Compare to Neighboring Countries

Country	IMR	U5MR	Life expectancy (Year)
Lao P.D.R.	118	193	50
Thailand	45	60	62
Vietnam	75	100	57
Myanmar	70	95	56
Indonesia	80	130	52

Source: Statistics on Children in assisted countries by UNICEF, 1986

Due to the very poor condition of public health as stated earlier, it is the most necessity of the project to be implemented in the shortest time.

b. Impact

If the project is implemented, the public health of residents in Vientiane Municipality would be upgraded by improvement of solid waste management as follows.

i. collection service

The purpose of solid waste management is the prompt collection/removal of solid waste generated by urban activities to maintain or improve the living environment and public hygiene.

Removal of waste can achieve the reduction of mosquitoes, flies and rats etc., which cause the two kinds of communicable diseases; one is due to poor sanitation (i.e. diarrhea, dysenteric parasistosis) and another is due to vector-borne diseases (i.e. dengue fever).

In the non-collection area, the waste is self-disposed at the premise or its surroundings such as road-sides by means of mainly open burning and partly landfilling. The open burning produce the air pollution which cause the respiratory diseases, (i.e. pneumonia) and conjunctivitis. These diseases are very popular in Vientiane, as shown in Fig. N.4-1.

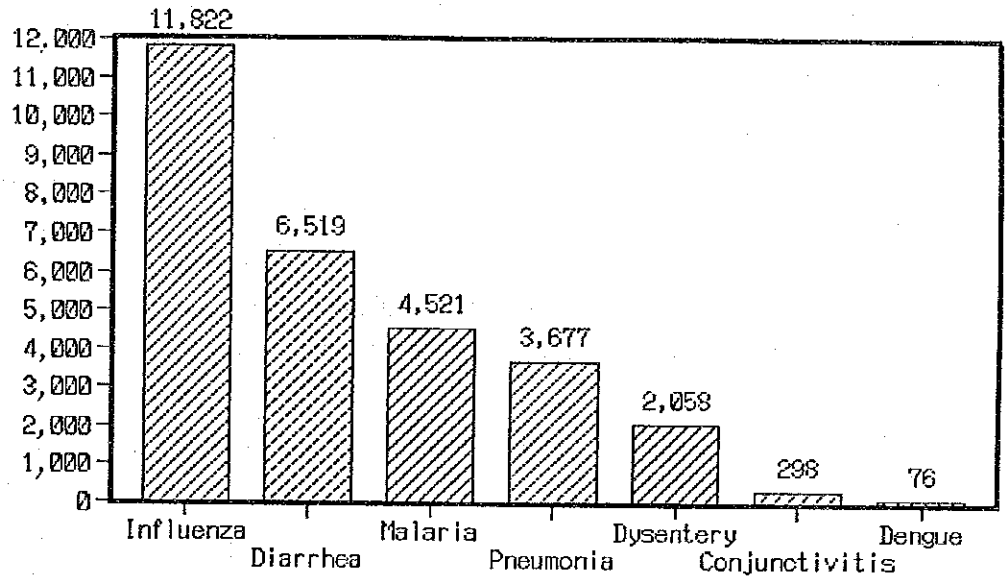


Fig. N.4-1 Number of patients by Kind of Diseases

Source ; Department of Health 1990, VM

ii. cleansing work

Garbage dumping by the residents along roads and in drains causes the clogging of drains which leads to flood and spread some diseases especially skin disease. In the rainy season water in bottles, tins and clogging drains will breed mosquitoes and make serious problems such as the outbreaks of dengue fever.

From the above, the cleansing work maintain and improve the living environment and public hygiene together with solid waste collection services.

2) Disposal Improvement

A major benefit by the realization of the level 2 sanitary landfill proposed is that the living environment and public hygiene standard would be upgraded as compared to the present situation of disposal site at KM 18.

The following positive effects to public health can be achieved by adopting the sanitary landfill method.

- Prevention of fire which can be causes diseases of the eye and respiratory organs of the residents in surrounding areas.

- Reduction scattering of waste, odors and the propagation of harmful insects and rats, etc.

- Hazardous wastes such as infectious waste from hospitals will be disposed at the designated disposal site to eliminate the possibility of communicable diseases outbreak.

- Avoidance of adverse environmental effects on the surrounding areas by the erection of fences to prevent the scattering of waste and prevent scavengers and animals entering the site.

N.4.4 Economic and Financial Evaluation

1) Framework of Evaluation

The project proposed consists of collection improvement, cleansing improvement and sanitary landfill at the final disposal site. The construction of a maintenance shop is also included for the smooth implementation of the works. The evaluation of the project was conducted on its economic and financial aspects.

The peculiarity of the SWM project, however, made the adaptation of the cost benefit analysis extremely difficult, particularly in Vientiane City where vehicles are limited and mostly dilapidated, and where the continuance of the collection services is met with danger. The calculation of the health damages effected by such practices like open burning in and around the Study area in monetarial terms, however, would prove worthless, as labour wages are relatively cheap in this country. Moreover, the calculations made by EIRR to conduct comparative analysis of projects can only be considered as arbitrary.

According to the above characteristics, the following basic policies were adopted to evaluate the project.

a. The economic evaluation will be basically based upon the minimization of expenses, that is, "the examination of the use of minimum cost to achieve the targeted standard service". Accordingly, the willingness of the residents and private enterprises to pay and their relationships shall be studied. It will be considered feasible, however, if the costs can be covered by the amount residents are willing to pay.

b. As for additional facilities, a study will be made on whether they will contribute to the curtailment of the cost or not.

c. The financial evaluation will confirm the possibilities of materializing the project under VM's available financial resources for SWM.

2) Economic Evaluation

a. Economic evaluation concept

Although economic evaluation is considered indispensable in judging the feasibility of a project from the national economic viewpoint, it is difficult to immediately measure the benefits of SWM.

In view of the above, economic evaluation was conducted according to the following steps:

- The effects of improvement in waste collection service and implementation of sanitary landfill will be qualitatively examined and evaluated.

- The effect of maintenance shop will be evaluated to prove that it can increase the efficiency of collection vehicles and reduce the total cost of SWM.

- A comparative study shall be made on the costs of large discharges of wastes in the container system, to confirm if the costs can be covered by the amount private enterprises are willing to pay.

- Finally, it will be verified if the total cost of SWM is less than the amount the inhabitants are willing to pay.

b. Economic evaluation of collection improvement project

It is apparent that SWM in a city concerns the immediate collection and removal of wastes generated from urban activities, to improve public health and preserve the environment.

Generally, the improvement of the collection services will have the following effects:

Regular collection	--- will limit the propagation of flies, mosquitoes, rats, etc., will prevent piling and littering of waste	--- will prevent spreading of diseases caused by blight and harmful insects.
		--- will prevent obstruction of traffic flow; will recover canal functions
	--- will prevent generation of offensive odor	--- will form a comfortable environment; will favorably impress tourists
Improvement of working conditions	--- will reduce diseases and injuries	--- will improve collection efficiency

The degree of the propagation of infectious diseases caused by blight and harmful insects in Vientiane is minimal, as most garbage are used as animal feed. On the other hand, irregular collection services cause air pollution and some diseases such as pneumonia because of uncontrolled open burning of wastes. The piling and littering of waste sometimes disturbs the function of urban canals and pollute groundwater. In view of the above, it is concluded that regular collection services are essential to the urban life of Vientiane, and therefore, improvement of collection services is needed urgently.

On the other hand, the establishment of the collection service project would open job opportunities in Vientiane where potential unemployment ratio is high.

It is, however, difficult to expect production induced effects such as infrastructural improvements. Although a comfortable environment would indirectly enhance working behavior and contribute to the improvement of production, these effects cannot be considered as benefits.

As for the collection system by containers, it is necessary to investigate quantitatively the effect of the reduction of the collection cost for discharges of large amount of waste, though it is clear that the system is beneficial to the waste collectors. Generally, the loading of large amount of waste takes quite some time. If the collection system that combines waste from households and shops and those from discharge of large amounts is adopted, a considerable amount of time will be wasted resulting in inefficient collection services. The separate collection system for large amounts gives only one trip per day. It is, however, possible to give 5 trips a day with the proposed system as the loading and unloading works are very efficient. The number of crews needed is also reduced. From these assumption, a 14% curtailment (see Table N.4-2) can be expected from the collection cost. On top of this, better impressions on market and hospitals will be expected as safety and cleanliness are maintained and the spreading of infectious diseases can be prevented. These are the indirect effects important for the beautification and sanitation of Vientiane.

Table N.4-2 Comparison of transportation cost of Institutional waste

Type of Vehicle	DCT *1	DT *2
1) Average amount of collection waste(ton/day)	8.0	as same as DCT
2) Average volume of collection waste(m3/day)	46.2	ditto.
3) Volume to be transfered per trip	5m3	10m3
4) Number of Trip per day	5	1
5) Number of Crew		
Driver	1	1
Worker	1	4
5) Number of Vehicle	2	5
6) Round-trip distance per trip(km)	36	46
7) Running cost per trip(Kips)	3,017	3,855
8) Purchase cost of Vehicles (1,000 Kips)	87,026	158,515
9) Purchase cost of containers (1,000 Kips)	38,974	
10) Depreciation (1,000 Kips)	18,984	20,381
11) Personnel cost (1,000 Kips)	900	5,490
12) Maintenance cost (1,000 Kips)	3,481	6,341
13) Running cost (1,000 Kips)	9,443	6,033
Total cost per year	32,808	38,245
Unit cost(Kips/ton)	13,102	15,274

Note: *1 DCT --- Detachable Container Truck
*2 DT --- Dump Truck

The cost share calculated is less than the limits the market owners and the hospitals are willing to pay.

c. Economic evaluation of cleansing improvement project

It is apparent that solid waste collection concerns the immediate collection and removal of waste generated from urban activities, in order to improve public sanitation and environment. In contrast with solid waste collection, however, it is difficult to specifically identify the waste dischargers in the case of cleansing services. Nevertheless, the residents of Vientiane are highly cooperative and are always seen cleaning the shop in ordinary days, participating together with other residents in cleansing day activities. The problem in this matter is the absence of a waste removal system which results in the scattering of waste as it is blown by the wind polluting the area once again. Furthermore, uncollected waste and those not removed obstruct passages which leads to accidents. It is difficult to quantify the damages, but benefits can be expected from the systematization of the cleansing services.

d. Economic effect of disposal by sanitary landfill

Generally, the shift from open dumping to sanitary landfill can improve public health and preserve the environment around the final disposal site.

Along with the prevention of waste scattering activities, generation of odor and propargation of rats and flies, the cell method in which soil covering is implemented, will be adopted to make the proper storage, stabilization, and sterilization of wastes possible.

The waste can be used as soil covering, too, after stabilization for a given period of time, and its ultimate use can be considered in future, thus ensuring a comfortable urban environment. Furthermore, the management of hazardous wastes, like infectious hospital wastes, will be done by the disposal of it at the designated place of the site in order to guarantee the safeties of workers and scavengers.

This will contribute to the formulation of proper sanitary landfill techniques, which is the basis of final disposal activities, and the implementation of technology transfer to other cities.

The direct effects of road improvement works and soil covering at the disposal site will lessen the possibilities of vehicular tire punctures by glass or nails, ensuring the working ratio of the collection vehicles. The O&M costs of the disposal site can be covered, therefore, with every 10% increase in the working ratio of vehicles.

There are no water treatment techniques, however, in the proposed level 2, therefore, requiring a supplementary improvement plan at least upto level 3 in the future. The present conditions of the location does not require water treatment as natural purification can be achieved. The future expansion of the disposal site, however, would require a water treatment technique, regardless of the increase in expenses to prevent adverse effects on agricultural production.

e. Economic evaluation of maintenance shop improvement project

The major effects of the improvement of the maintenance shop are the prolongation of the life of the vehicles and the augmentation of the working ratio. The maintenance shop proposed at present does not include a large-scale overhaul, instead the efficiency of the collection and disposal works will be increased through the daily execution of check-ups and repairs.

The former maintenance system in Vientiane was not satisfactory as observed from the questionable operational capability of the vehicles, where the execution of one trip per day of collection work was uncertain. Based on these, the proposed maintenance system will be improved to enable 3 collection trips/day to main streets of town and 2 collection trips/day to the surrounding area. Concurrently, a fixed collection time will be established and the collection services will be improved.

Above everything else, a fixed collection time would heighten the willingness of the residents to pay, as observed from their response in the collection experiment.

If 3 trips/day to the main streets of town can be guaranteed through the provision of a maintenance shop, a slight reduction in the costs can be expected as shown in Table N.4-3.

A considerable curtailment of costs can be expected, however, if the collection trips in the surrounding area and the working efficiency of the disposal site equipment are improved.

3) Financial Evaluation

a. Financial evaluation concept

Financial evaluation may be broadly divided into the following two fields:

- Financial evaluation of each project proposed
- Analysis of the project's impact on SWM in Vientiane as a result of its implementation.

Table N.4-3 Comparison of the collection services with a maintenance-shop and without a maintenance-shop

	with maintenence-shop	without maintenence-shop
· Average amount of collection waste*	30.2	as same as with project
· Average volume of collection waste	174.5	ditto.
· Volume of waste per trip	10m3	ditto.
· Number of Trips per day	3	1
· Number of Crews		
Driver	1	as same as with project
Workers	4	ditto.
· Number of Vehicles	6	18
· Round-trip distances per trip(km)	56	as same as with project
· Running cost per trip(Kips)	4,693	ditto.
· Purchase cost of Vehicles	190,218	570,654
· Cost of collection		
Depreciation	24,457	73,370
Personnel cost	6,588	19,764
Maintenance cost	7,609	22,826
· Total running cost	26,440	26,440
Sub-total	65,094	142,400
· Cost of maintenance-shop		
Depreciation	28,737	-
Personnel cost	2,970	-
Sub-total	31,707	-
Total cost per year	96,801	142,400
Unit cost(Kips/ton)	10,241	15,065

Note; * The average amount of collected waste is calculated by assuming that the volume to be collected from the center of the town is 60% of the 1995 collection.

The former is to compare the revenue and expenses in 1995 and to determine the feasibility of this project. The latter is to examine the financial capability of VM to continue the project and to achieve the goal of the Basic Plan based on the project proposed in the feasibility study. The latter includes the study of a 15 year cash flow and a sensitivity analysis on financial resources, initial investment cost, loan condition and inflation.

The revenue by fee collection is assumed to be the same as in the level proposed in N.2.2 based on the consciousness survey and the collection experiment.

b. Financial evaluation of collection services

It is possible to collect waste from 80 households within an hour as the residents are found to be highly cooperative. The major items involved in this financial evaluation are as follows:

- working days per week	: 5 days
- number of trips per day	: 3 trips per day from the central urban area by DT (dump truck)
- discharged waste	: 1.5 bamboo basket for every contractor, including wastes from shop.
- frequency of collection	: once a week for households and shops 1.3 times or 1.4 times per week for container system
- volume of extra service	: 20% of waste discharged from households and shops

From the tariff and the above assumption, the revenue for collection service is as follows:

Unit : million kips

Revenue	Basic Fee	241.2	13,400 households x 1.5 basket x 1,000 kips x 12 month
	Extra Fee	64.9	830 baskets x 250 kips x 313 days
	Special Fee	13.6	29 containers x 1.3 times x 30,000 kips x 12 month
	Sub-total	319.7	

The cost is estimated in Section N.3. The comparison of revenue and cost indicates that the balance of the collection service is in the black even with the inclusion of the depreciation for vehicles, etc.

Table N.4-4 Balance of Collection Service in 1995

Unit : million Kips

Revenue		319.7
Expense	Personnel	18.5
	Utility	66.1
	Maintenance	22.5
	Sub-total	107.1
Balance		212.6
	Depreciation	123.1
Balance including depreciation		89.5

The balance, including the depreciation, however, would be in red if the share for the final disposal, maintenance shop and managerial costs are taken into consideration especially due to the share of the final disposal cost. But if half of the depreciation value can be covered by mean of financial assistances from the Central Government or other agencies, the collection services can be highly beneficial.

Table N.4-5 Balance of Collection Service Considering Other Operational Shares in 1995

Unit : million kips

a. Revenue	319.7	
b. Expense		
Personnel	18.5	
Utility	66.1	
Maintenance	22.5	
Sub-total	107.1	
c. Balance by work (a-b)	212.6	
d. Other operation share		
Final disposal	126.7	(52.1)
Maintenance shop	21.0	
Managerial cost	16.4	
Sub-total	164.1	(89.5)
e. Balance (c-d)	48.5	(123.1)
f. Depreciation for collection service equipment	123.1	
g. Balance including depreciation (e-f)	-74.6	(0)

Note: The figure in parentheses indicates it of which revenue and expenditure keep the balance.

c. Financial evaluation of the final disposal site

Tipping fees are the only direct source of revenue for the final disposal site.

By estimating the number of incoming vehicles at present, the mean number of incoming vehicles in the disposal site for 1995 is as shown below.

Table N.4-6 Number of Vehicle by Size in 1995

Type	Nos./day
Small Vehicle	1.2
Medium Vehicle	1.5
Large Vehicle	3.9

Accounting, the revenues are as shown in the Table below.

Table N.4-7 Revenues from Tipping Fees in 1995

Unit : million kips

	Revenue	Calculation
Small Vehicle	0.2	1.2 nos. x 600 kips x 313 days
Medium Vehicle	0.4	1.5 nos. x 800 kips x 313 days
Large Vehicle	1.2	3.9 nos. x 1,000 kips x 313 days
Sub Total	1.8 million kips	

The annual landfill expenses is 19.7 million kips, and only the labor cost can be covered by the tipping fees. If the revenue and expenditure of collection service keep the balance, the share by collection fee is 52.1 million kips. Consequently it results a deficit of 74.6 million kips, as shown in Table N.4-8.

Table N.4-8 Balance of Final Disposal Service

Unit: million kips

a. Revenue	Tipping Fee	1.8
	Collection	52.1
	Sub-total	53.9
b. Expense	Personnel	1.7
	Utility	12.7
	Maintenance	5.3
	Sub-total	19.7
c. Balance by work (a-b)		34.2
d. Other operational share		
	Maintenance shop	5.2
	Management	1.0
	Sub-total	6.2
e. Balance (c-d)		28.0
f. Depreciation for final disposal facility and equipment		102.6
g. Balance including depreciation (e-f)		-74.6

As shown above, the management of the disposal site is largely dependent on the collection fees of the collection services.

d. The Cost Share of VM and the Financial Analysis of its SWM

As described above, the project balance without the road sweeping works results a deficit of 74.6 million kips due to the final disposal cost, especially depreciation of the facility and equipment. The deficit will, however, be covered by the increase of the collection fee. Nevertheless, the impact of the implementation of the project on the financial status of VM is looked into below.

Similar to the Basic Plan, a 15 year cash flow is formulated. The required investment for the vehicles, replacement of machineries, and the securement of the disposal site shall be estimated based on the nature of the project (see Table N.4-9). Annual cost is estimated and tabulated in Table N.4-10

In the calculation, the annual expenses shall not be changed after 2000, and the same concept shall be applied to the fee collection. As for the financial resources, the first and the 1997 investment for the construction of the disposal site was derived from a long-term foreign loan, and the money for the annual purchase of machineries shall be appropriated from the internal funds like depreciation. If the internal funds are lacking, a short term domestic loan shall be made. Meanwhile, the annual expenses for road sweeping works will be covered by public taxes and, therefore, appropriated from the VM budget.

Consequently, the balance shall be in black by the year 2000. However, since an overall debt will become 3,825 million kips, an outflow of 391 million kips for repayment of long-term loan including interest, which is equivalent to 74% of the depreciation, will be made, as shown in Table N.4-11..

Table N.4-9 Investment Plan for SWM of VM

(Unit : million Kips)

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Collection																	
Vehicle	682.4	150.6	150.6	202.3	150.6	150.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	682.4	150.6	150.6	202.3	150.6	150.6	0.0	682.4	150.6	150.6
Container etc.	177.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	177.0	0.0	0.0	0.0	0.0	177.0	0.0	0.0	0.0	0.0	177.0	0.0
Final Disposal				*1													
Construction	355.3	0.0	0.0	2345.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heavy Equip.	301.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	301.4	0.0	0.0	0.0	0.0	0.0	0.0	301.4	0.0	0.0
Cleansing Work																	
Vehicle&Equipment	236.9	0.0	0.0	0.0	67.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	236.9	0.0	0.0	0.0	67.2	0.0	0.0	236.9	0.0	0.0
Container	67.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	67.2	0.0	0.0	0.0	0.0	67.2	0.0	0.0	0.0	0.0	67.2	0.0
Grass cutter	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0	7.4	0.0
Management & Other																	
Motorcycle	36.2	6.1	6.1	8.1	6.1	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.2	6.1	6.1	8.1	6.1	6.1	0.0	36.2	6.1	6.1
Shop	130.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Equipment etc.	122.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
(Renewal)	0.0	0.0	0.0	0.0	0.0	122.0	0.0	0.0	0.0	0.0	122.0	0.0	0.0	0.0	0.0	122.0	0.0
Total	2115.9	156.7	156.7	2555.5	223.9	530.3	0.0	1256.9	156.7	156.7	584.0	223.9	156.7	0.0	1256.9	530.3	156.7

Note : *1 Construction cost of final disposal site upto 2012 is included.

Table N.4-10 Annual Cost Estimates

(Unit : million Kips)

	1995	1996	1997	1998	1999	2000
Disposal Site						
Personnel	1.7	1.7	1.7	2.8	2.8	2.8
Utility	12.7	15.5	18.4	21.2	24.1	26.9
Maintenence	5.3	6.5	7.7	8.8	10.0	11.2
Depreciation	102.6	102.6	102.6	201.2	201.2	201.2
Sub-total	122.3	126.4	130.4	234.1	238.1	242.1
Collection etc						
Personnel	18.5	22.9	27.3	33.1	37.5	41.9
Utility	66.1	73.6	81.0	88.5	95.9	103.4
Maintenence	22.5	26.6	30.7	34.9	39.0	43.1
Depreciation	123.1	142.5	161.9	187.9	207.3	226.6
Sub-total	230.2	265.5	300.9	344.3	379.6	415.0
Cleansing						
Personnel	9.0	9.0	9.0	10.5	10.5	10.5
Utility	64.8	64.8	64.8	64.8	64.8	64.8
Maintenence	7.1	7.5	7.9	8.3	8.7	9.1
Depreciation	45.4	45.4	45.4	45.4	54.0	54.0
Sub-total	126.3	126.7	127.1	128.9	138.0	138.4
Maintenence						
Personnel	3.0	3.0	3.0	4.8	4.8	4.8
Utility						
Maintenence						
Depreciation	28.7	28.7	28.7	28.7	28.7	28.7
Sub-total	31.7	31.7	31.7	33.5	33.5	33.5
Management etc						
Personnel	9.2	9.8	10.5	13.8	14.5	15.1
Utility	3.5	4.1	4.7	5.4	6.0	6.6
Maintenence	1.0	1.2	1.4	1.5	1.7	1.9
Depreciation	4.7	5.4	6.2	7.3	8.0	8.8
Sub-total	18.3	20.6	22.8	28.0	30.2	32.5
Total	528.8	570.8	612.8	768.8	819.4	861.4

Table N.4-11 Calculation of Balance, Debt and Depreciation

(Unit : million Kips)

	1995	1996	1997	1998	1999	2000
Case 1						
Balance	-144	-95	-42	-74	-4	51
Total Debt	2,116	2,116	4,337	4,212	4,155	3,825
Depreciation (A)	304	325	345	470	499	519
Repayment of Long Term Loan (B)	0	0	124	124	124	262
Interest of Long Term Loan (C)	63	63	63	130	126	123
B+C	63	63	188	255	251	385
(B+C)/A*100 (%)	20.8	19.6	54.5	54.1	50.3	74.1
Case 2						
Balance	-81	-28	30	7	86	153
Total Debt	0	0	2,345	2,345	2,345	2,207
Depreciation (A)	304	325	345	470	499	519
Repayment of Long Term Loan (B)	0	0	0	0	0	138
Interest of Long Term Loan (C)	0	0	0	70	70	70
B+C	0	0	0	70	70	208
(B+C)/A*100 (%)	0.0	0.0	0.0	15.0	14.1	40.1

Note:

Case 1 is the case in which the initial investment is made by a loan.

Case 2 is the case in which the initial investment is made by a grant.

A budget allocation to SWM in VM budget is assumed and tabulated in Table N.4-12 based on the calculation of the cash flow. Although the SWM public share for 1995 and 2000, 120 million kips and 132 million kips, respectively, does not show much discrepancy, these budgets are more than 10 times of the present. If the increase ratio of VM budget will be in proportion to that of GRDP, the SWM budget will share 3.5% in 1995 and 7.7% in 2000 while the present ratio is only 0.3% in 1990.

Table N.4-12 The Budget Allocation to SWM in VM Budget (Foreign Loan)

(Unit : million Kips)

	1995	1996	1997	1998	1999	2000	Total
SWM							
for investment*	(157)	(157)	(210)	(224)	(530)	(0)	(1,278)
for public share	126	127	127	129	138	138	785
for loan repayment	0	0	124	124	124	262	634
for interest	63	63	63	130	126	128	573
(short term loan)	(0)	(0)	(0)	(0)	(0)	(5)	
Total (A)	189	190	314	383	388	528	1,983
VM budget (B)	5,388	5,658	5,941	6,238	6,549	6,877	
A/B x 100 (%)	3.5	3.4	5.3	6.1	5.9	7.7	

Note: VM budget (B) means budget, excluding foreign aids, in local currency.

* The investment required for the purchase of collection vehicles will be released from the internal reserve and VM budget will be used for public share, and repayment of loan and interest.

The present budget of VM highly depends on foreign aids and foreign long term loans. On foreign loan, the average repayment term is 41 years, the average grace period is 21 years and average interest is 0.6 percent in 1989. This indicates the critical situation Lao P.D.R. is in, in terms of foreign debts.

Cash flows of the project both in cases of loan and grant aid are prepared, and shown in Fig. N.4-2 and N.4-3 , respectively. As shown in the figures, if the initial investment is to be financed by foreign aids, the project will be financially well off and the balance will change to black in 1997. The total amount for the repayment and interest of foreign long term loans is 208 million kips, about 40 percent of the depreciation values, in spite of a total debt of 2,207 million kips in 2000 (see Table 11.4-11).

Conclusively, the financial situation in 2010 will be improved through an aid.

e. Sensitivity analysis

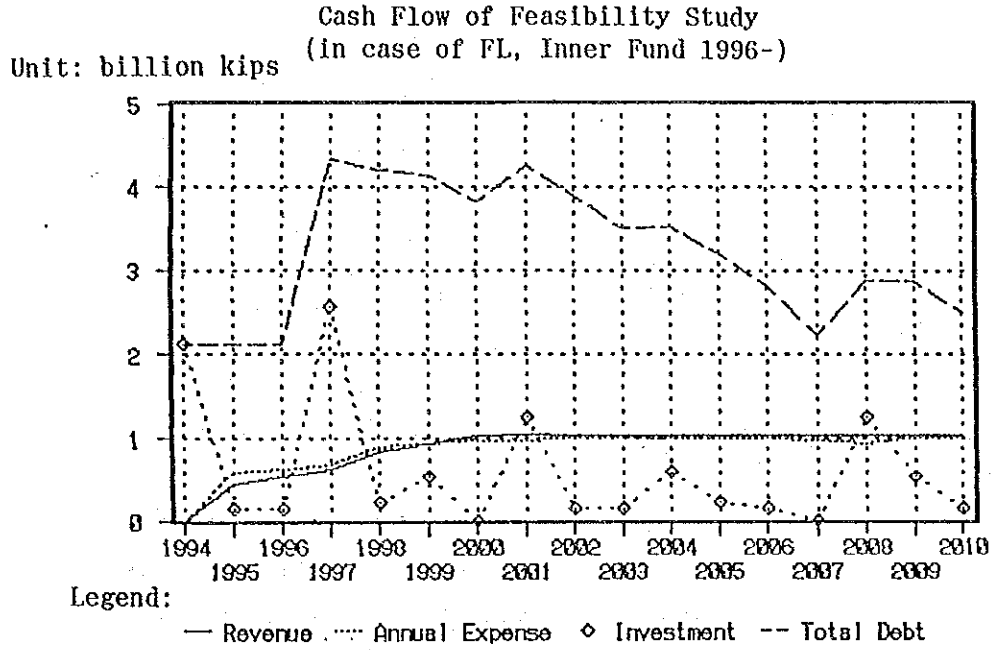
A sensitivity analysis is done regarding financial sources, amounts of investments, collection fees, conditions of loans and inflation rates as follows.

i. financial sources

As described in the previous section d., a comparison study is done regarding the initial investment by a loan and aid. The results are shown in Fig. N.4-2 and Fig. N.4-3 .

ii. amounts of investments

- Case 1 : Comparison of Initial Investment Amount (by Loan)



Note : 20 years repayment with three years grace period and 3% of interest ratio

Fig. N.4-2 Cash Flow of Project in Case of Loan

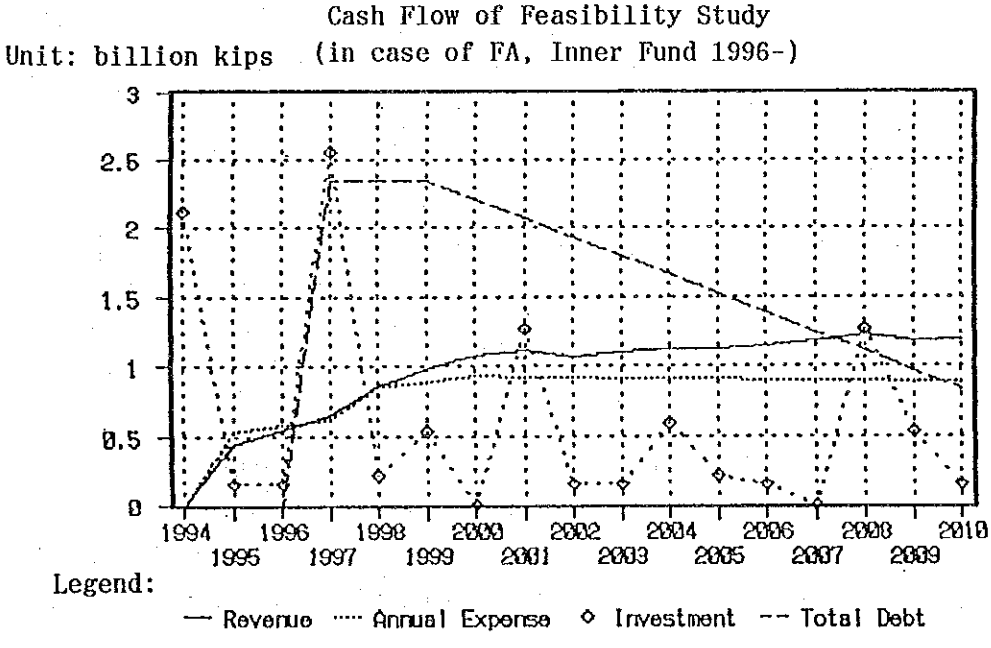


Fig. N.4-3 Cash Flow of Project in Case of Grant Aid

The cases, of which the initial investment amount is 80%, 100% and 120% of the estimated cost, are studied and shown in Fig. N.4-4 .

As the results, it indicates that the balance of revenue and expenditure after 2000 will not be affected so much by the amount of initial investment.

- Case 2 : Comparison of Initial Investment Amount (by Grant)

The cases, of which the initial investment amount is 80%, 100% and 120% of the estimated cost, are studied and shown in Fig. N.4-5 .

The results show that the balance after 2000 will not be influenced very much by the amount of initial investment.

- Case 3 : Comparison of Investment Amount for Disposal Site Development (by Grant)

The cases, of which the level of disposal site development in 1997 is level 2 and level 3, are studied and shown in Fig. N.4-6 .

There will not be so much difference between the balances of level 2 and level 3 of site development after 2000.

iii. collection fees

- Case 4 : Comparison of Basic Fee (by Loan)

The cases, of which the basic fee for collection is 80%, 90% and 100% of the proposed fee (1,000 kips/month/household), are studied and shown in Fig. N.4-7 . The other modes of fee are supposed to be the same price as proposed.

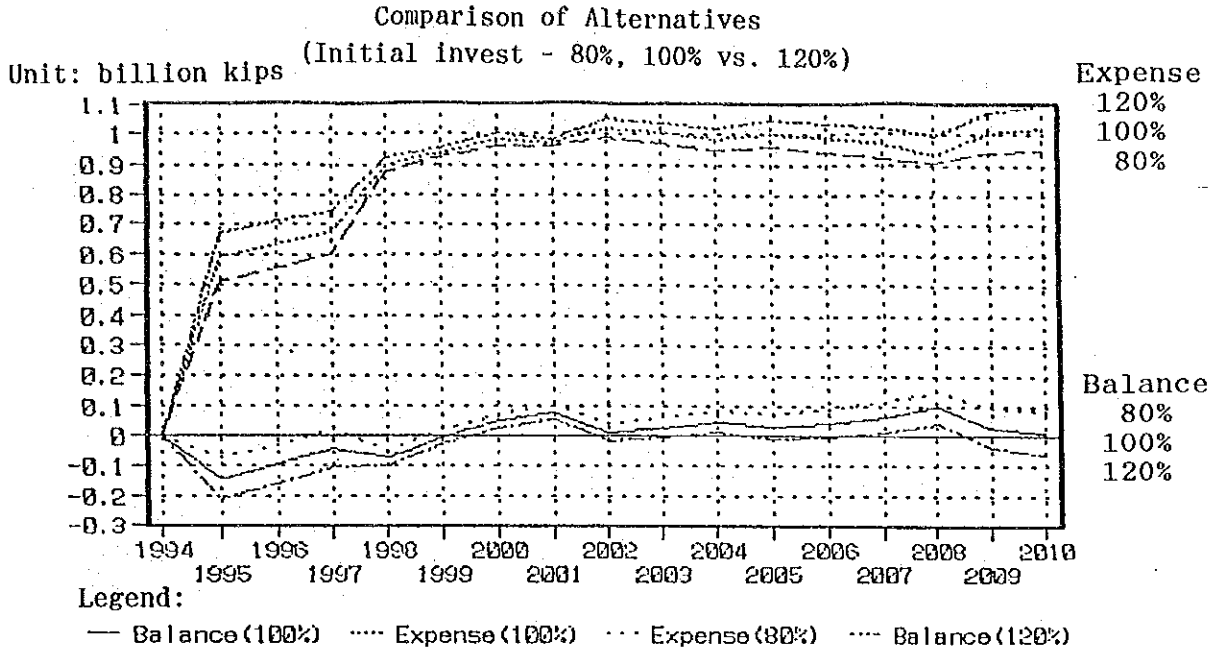


Fig. N.4-4 Sensitivity Analysis Case 1

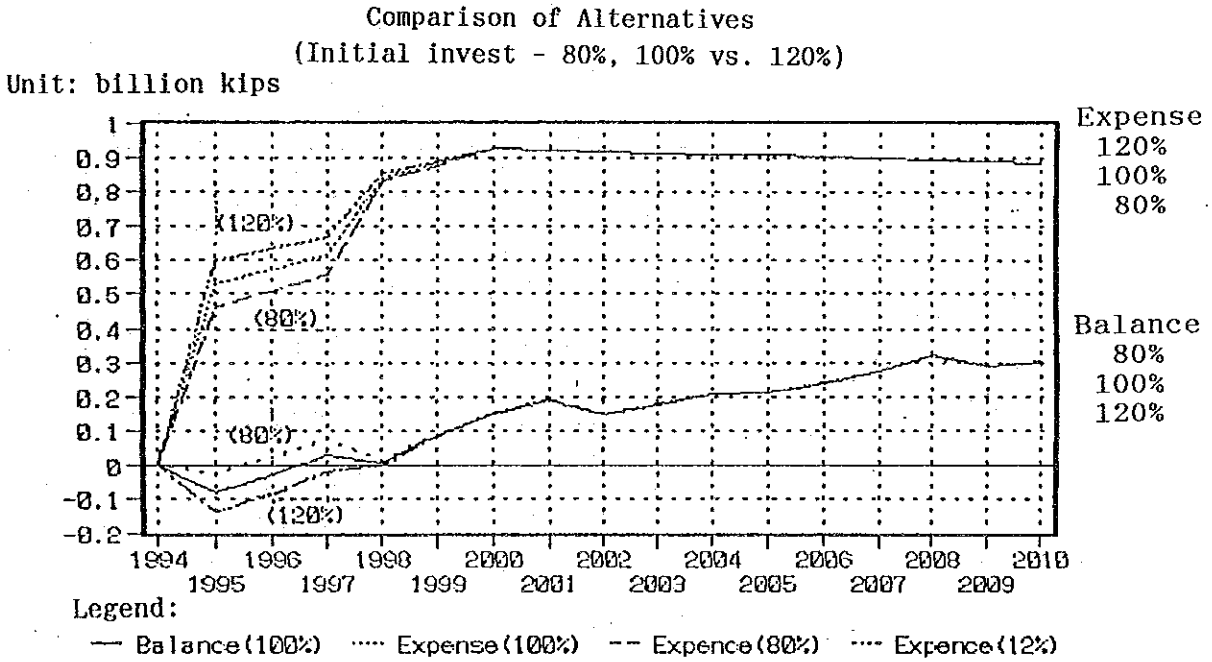


Fig. N.4-5 Sensitivity Analysis Case 2

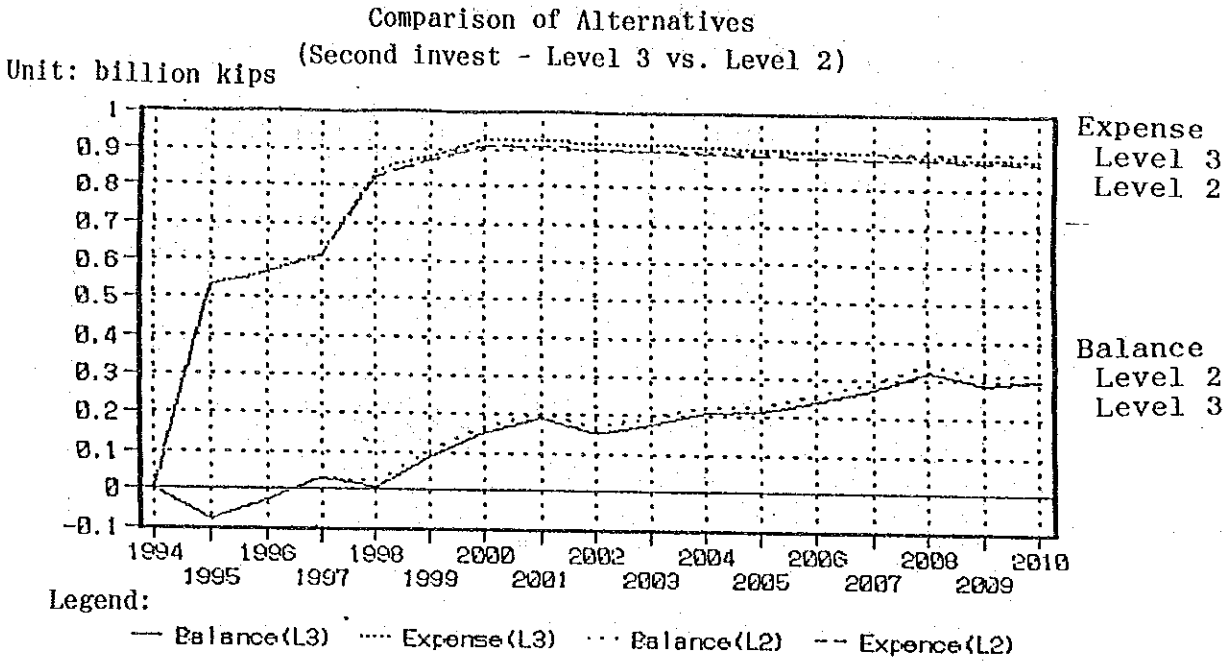


Fig. N.4-6 Sensitivity Analysis Case 3

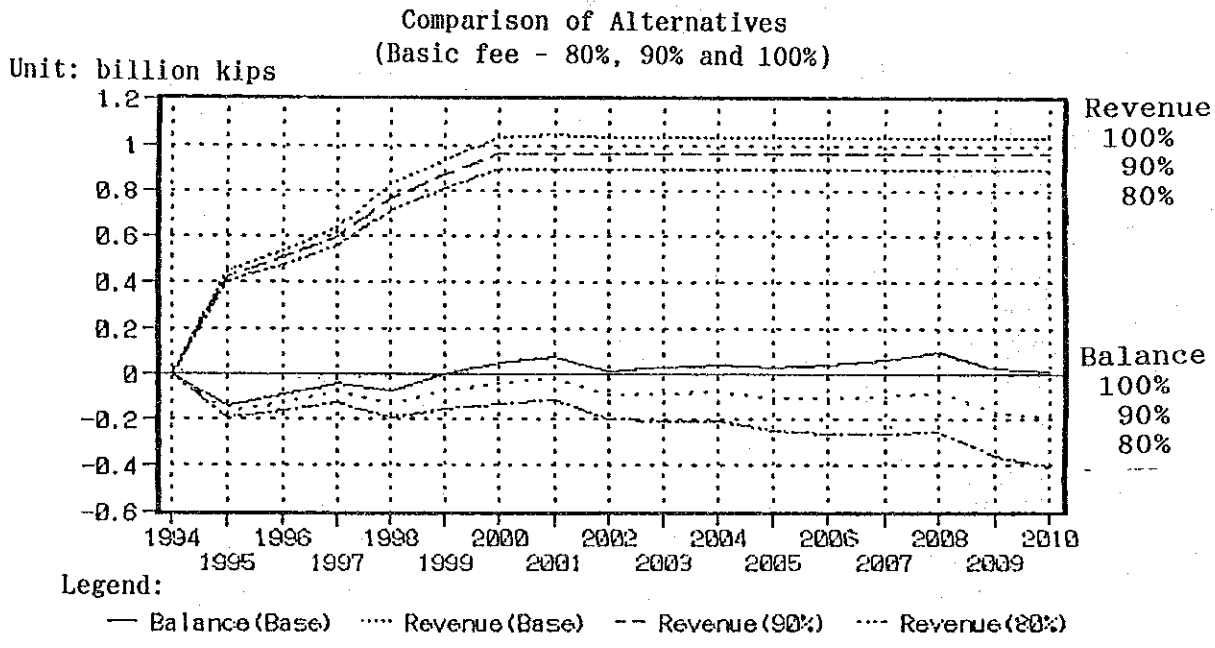


Fig. N.4-7 Sensitivity Analysis Case 4

- Case 5 : Comparison of Basic Fee (by Grant)

  The cases, of which the basic fee for collection is 80%, 90% and 100% of the proposed fee, are studied and shown in Fig. N.4-8. The other fees are considered as the proposed prices of fees.

- Case 6 : Comparison of Extra Fee (by Grant)

  The cases of with the extra fee for collection (100%) and without it (0%) are studied and shown in Fig. N.4-9 .

As the results of analysis, it indicates that

- In case of a loan, 10% price reduction of basic fee will make a deficit of revenue and expenditure.

- In case of a grant, 10% reduction of basic fee will keep the balance in black. However, without extra fee collection the balance will be in red.

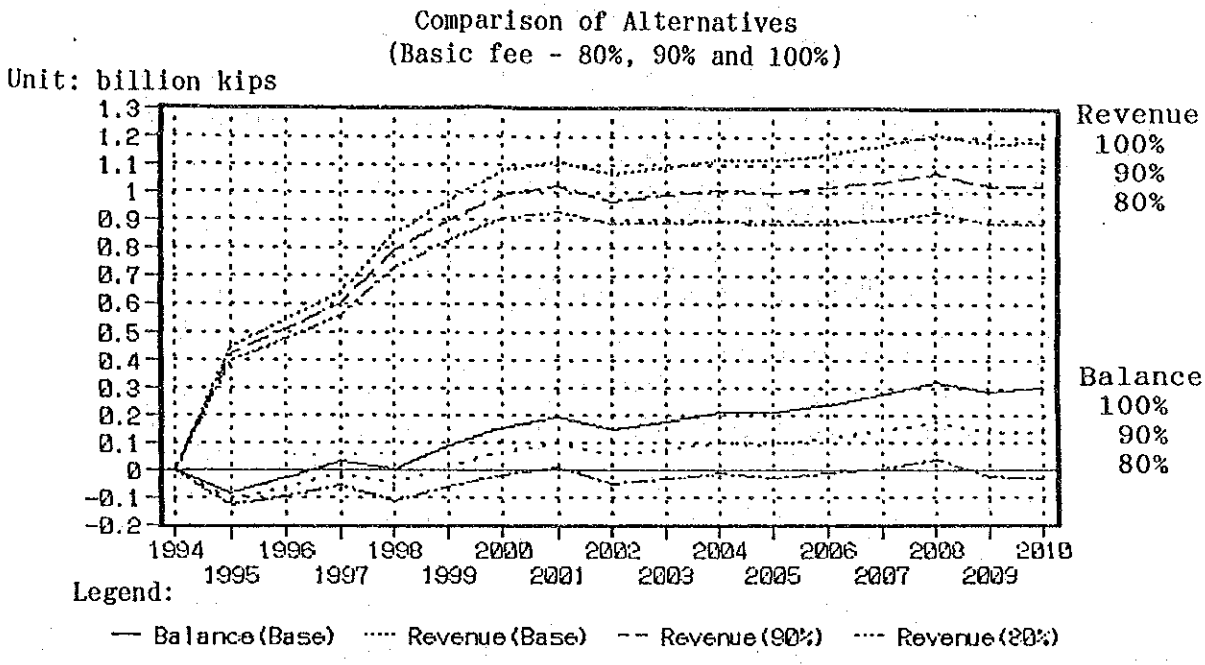


Fig. N.4-8 Sensitivity Analysis Case 5

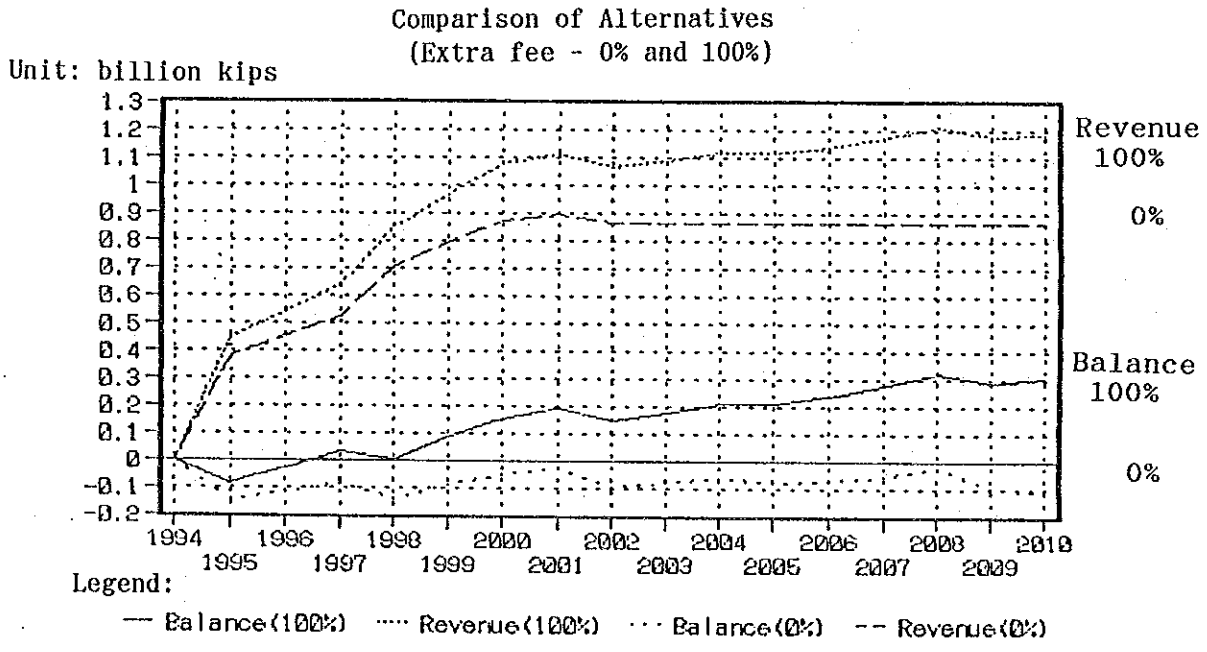


Fig. N.4-9 Sensitivity Analysis Case 6

iv. loan conditions

- Case 7 : Comparison of Repayment Period (by Loan)

The following three cases regarding repayment period are studied and shown in Fig. N.4-10 . In each case, the interest rate is set at 3%.

* 10 years with 3 years grace period
* 20 years with 3 years grace period
* 30 years with 10 years grace period

- Case 8 : Comparison of Interest Rate (by Loan)

The cases, of which the interest rate is 0.3%, 3% and 6%, are studied and shown in Fig. N.4-11 . In each case, the repayment period is supposed to be 20 years with 3 years grace period.

As results of analysis, it shows that the balance can be in black if the repayment period is more than 20 years and that if the interest rate is 6%, the balance will be in red.

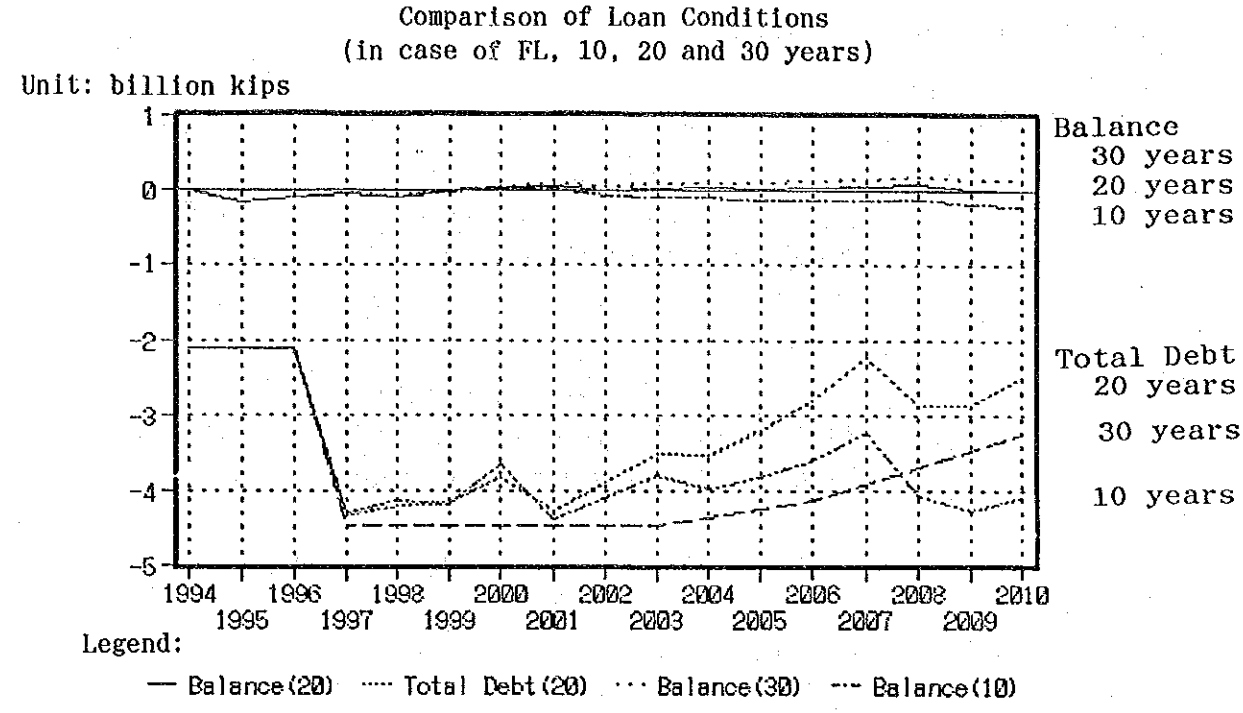


Fig. N.4-10 Sensitivity Analysis Case 7

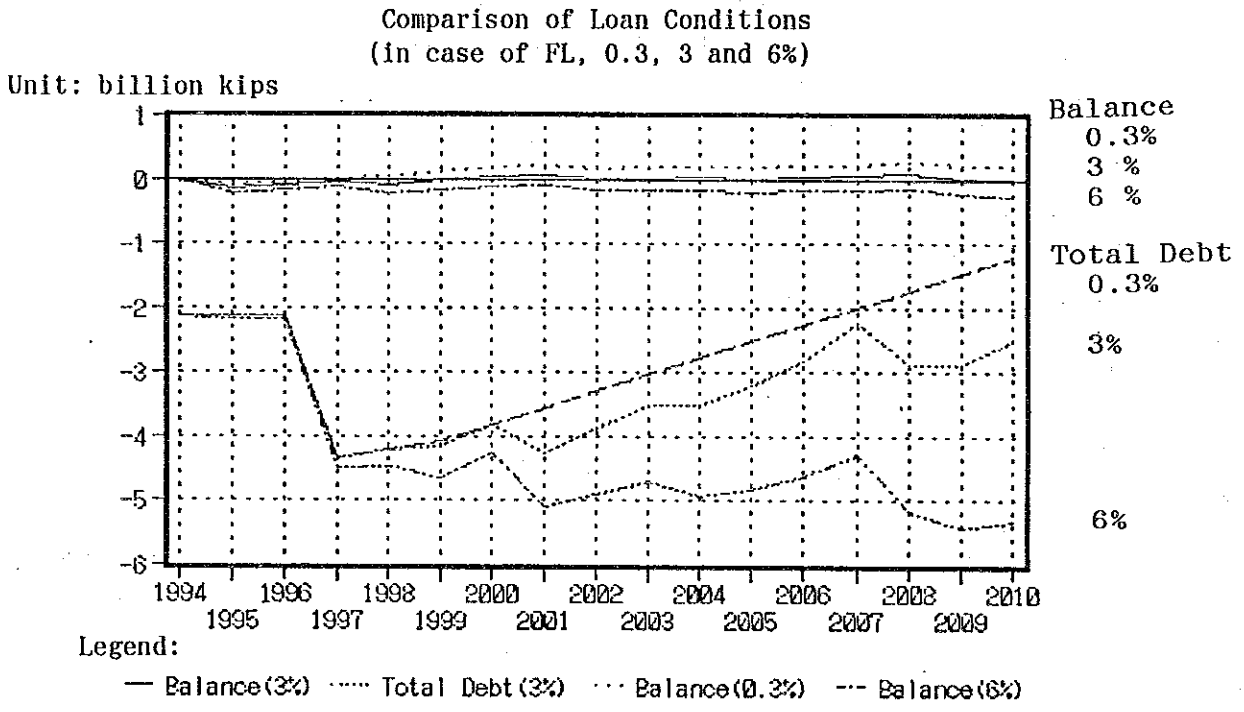


Fig. N.4-11 Sensitivity Analysis Case 8

v. inflation rates

- Case 9 : Comparison of Inflation Rates (by Grant and Renewal Investment by 100% of Internal Reserve)

  The cases, of which the inflation ratio is 3% and 5%, is studied and shown in Fig. N.4-12 .

- Case 10 : Comparison of Inflation Rates (by Grant and Renewal Investment by 50% of Internal Reserve and 50% of VM Budget)

  The cases, of which the inflation ratio is 3% and 5%, is studied and shown in Fig. N.4-13 .

The results indicate that without VM budget for renewal investment, the balance will be in red while with VM budget the balance will be in black even if 5% of inflation.

f. Overall evaluation

The final disposal improvement project will make a considerable deficit (128.5 million kips in 1995).

Even in case of the initial investment covered by a grant, if the collection fee tariff is equivalent to the one proposed and a 5% increase in personnel cost and investment are gained, the balance will remain in red after 1998, and the overall debt will amount to 4,200 million kips in 2007 due to interest rates. After 2007 overall debt will increase steadily and incapacitates the internal reserves from financing the new investments required.

To avoid such consequences, the fee tariff shall be reviewed or the half of renewal investment shall be financed by the VM budgets.

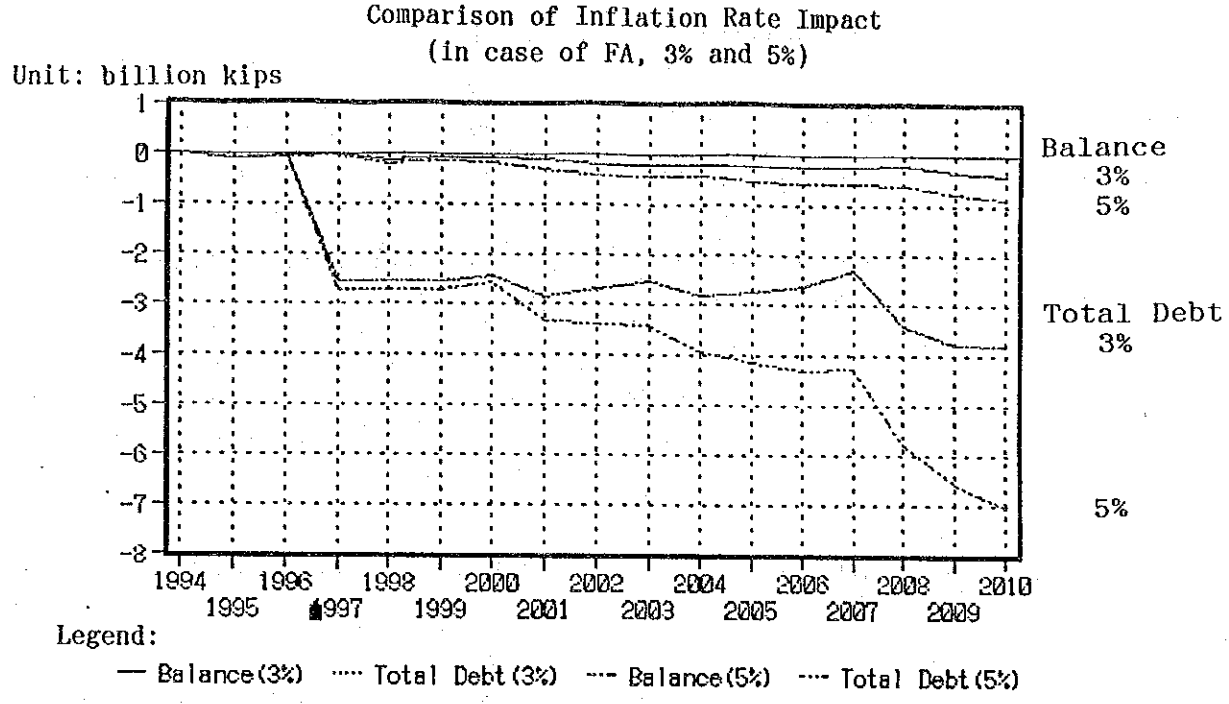


Fig. N.4-12 Sensitivity Analysis Case 9

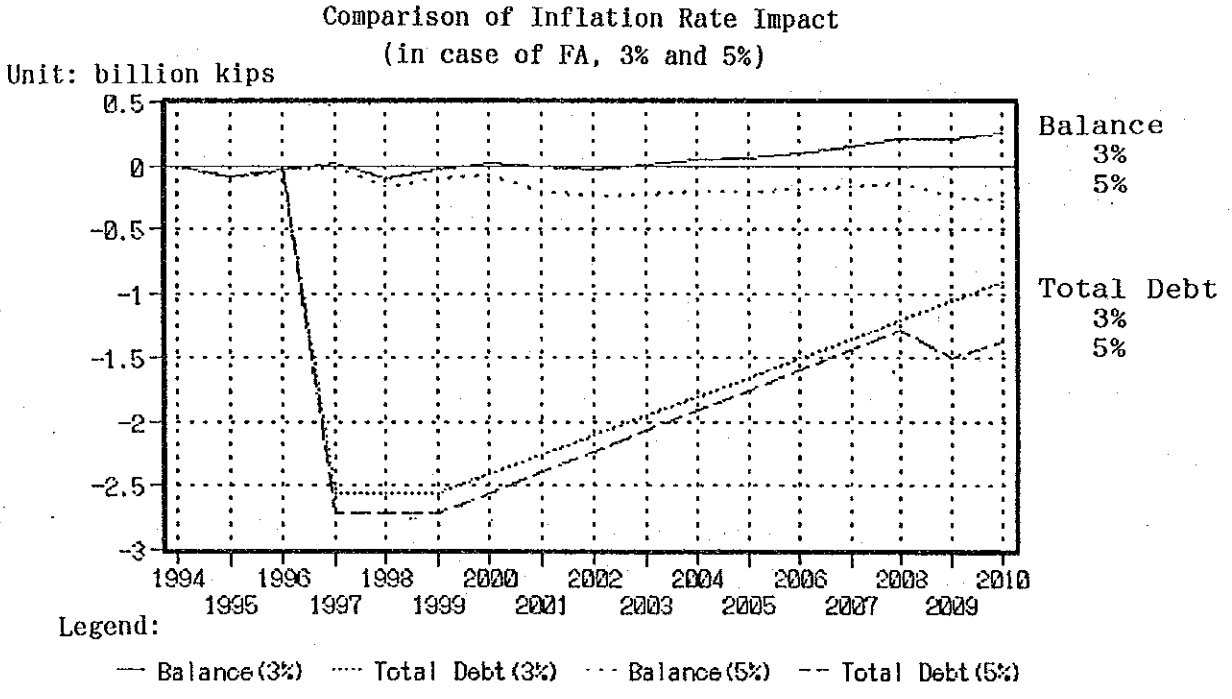


Fig. N.4-13 Sensitivity Analysis Case 10

It can be concluded, therefore, that the profitability of the SWM project will largely depend on the positive cooperation of VM and the financial support by any modes of grants, especially during the time of take off.

N.5 Implementation Plan

N.5.1 Operation Manual for SWM

The present operational capability of DCTC on solid waste management in Vientiane is very poor. Actually, there is no operational manual in DCTC. In order to execute the collection experiment and to continue the experiment by DCTC, the Study Team prepared a draft manual for operation SWM. Based on this, DCTC is continuing the experiment. It is requested that DCTC shall review and modify the draft manual in accordance with progress of their work.

Outline of operation for SWM shown in Fig. N.5-1.

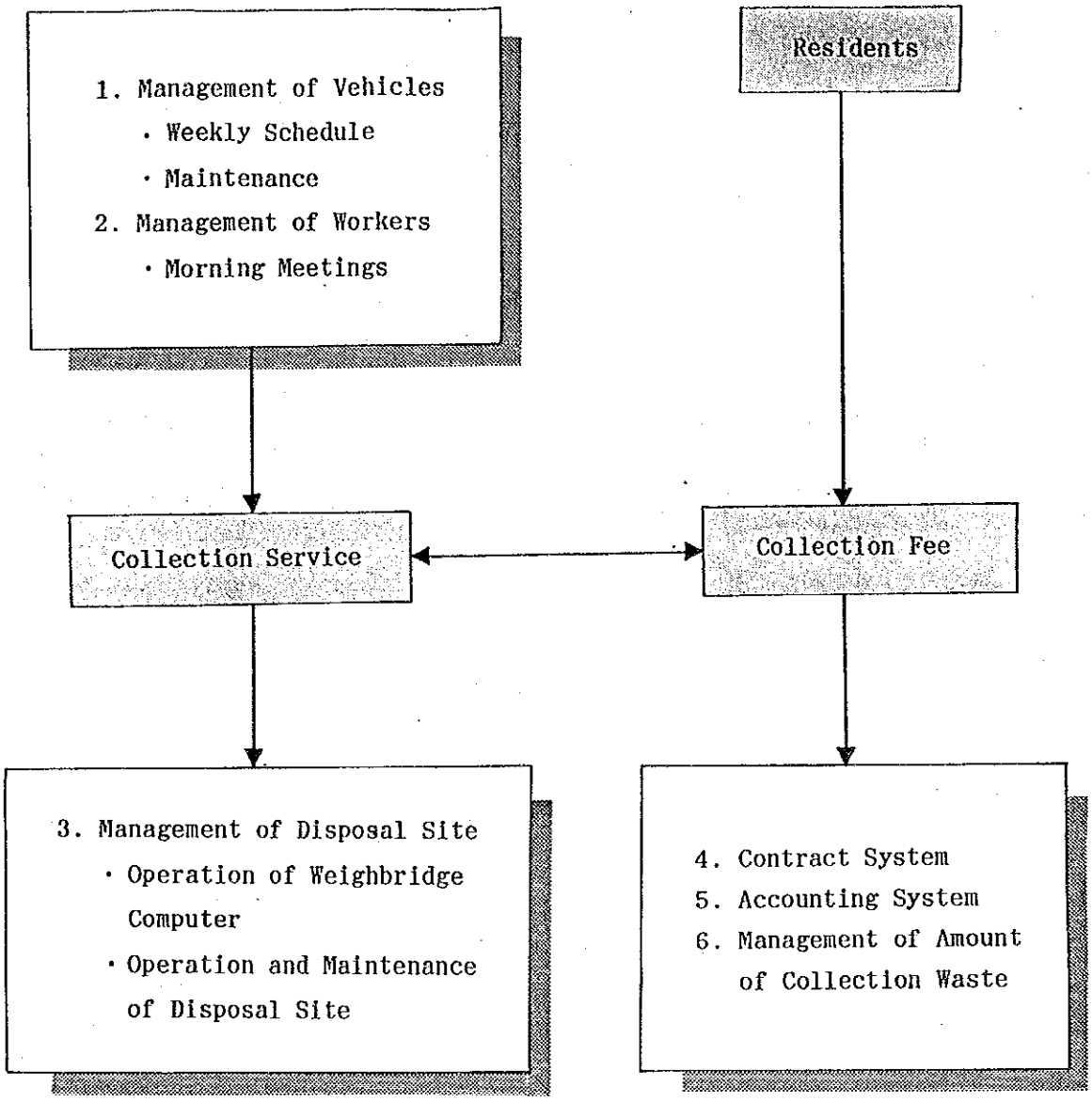


Fig. N.5-1 Outline of Operation for SWM

1) Management of Vehicles

a. Weekly schedule

. A person in charge : Mr.Udomsai
. His duty :
. Contents of Work :

He has to check a vehicle which is need to repair this week and a collection area which was not covered last week.

Then he has to adjust the weekly schedule for collection vehicles.

Weekly Schedule of collection vehicle is shown in Table N.5-1.

Table N.5-1 Weekly Schedule of Collection Vehicle

Week	Vehicle No.	Collection Areas(Plan)	Collection Areas(Execution)	Departure	Arrival
	383	Ban Dong Mieng		:	:
( )	116			:	:
Mon.	160	Ban Hai Sok, Samsenthai Road		:	:
	238	Embassy of USA and Road		:	:
	248	Beer Company		:	:
	383	Ban Sisavath Tay		:	:
( )	116			:	:
Tue.	160	Ban Sikhay		:	:
	238	Mahosot Hospital		:	:
	248	Beer Company		:	:
	383	Ban Sisavath Kang		:	:
( )	116			:	:
Wed.	160	Soviet Culture Center		:	:
	238	Ban Hai Sok		:	:
	248	Sisattanak District		:	:
	383			:	:
( )	116			:	:
Thu.	160	Embassy of USA		:	:
	238	Nong Douang Market		:	:
	248	150 Hospital		:	:
	383			:	:
( )	116			:	:
Fri.	160	Naxai Restourant		:	:
	238	Embassy of France and UNO		:	:
	248	Ban Hai Sok		:	:
	383			:	:
( )	116			:	:
Sat.	160			:	:
	238			:	:
	248	Beer Company		:	:

b. Maintenance

. A person in charge : Mr. Bounsi
. His duty : Mechanic
. Contents of Work :

Drivers and operator should inspect dump trucks and bulldozer according to daily check list and make a file as a daily report. And also cycle time is recorded by themselves. Mechanic should checks those reports.

Dump trucks and bulldozer are inspected once a three month by mechanic in the maintenance workshop. At that time, repair specification sheet are recorded by mechanic. Daily check list, cycle time and repair specification sheet are shown in Table N.5-2~ N.5-4 respectively.

Table N.5-2 Daily Check List

No	Day / Item												
1.	Engine												
	1. Water												
	2. Engine Oil												
	3. Fan Belt												
2.	Clutch												
	1. Clutch Pedal												
	2. Oil Fuel												
3.	Universal Joint												
	1. Check Gease												
	2. Joint Bolt												
4.	Transmission												
	1. Check Oil												
	2. Oil Leakage												
5.	1. Battery Water												
	2. High Tension Cable												
	3. Starter Motor												
	4. Fuse Block												
6.	Body												
	1. Door Lock												
	2. Front Glass												
7.	P.T.O.												
	1. Power Take Off Lever												
	2. Joint												
8.	Power Steering												
	1. Pump												
	2. Velt												
	3. Cylinder												
9.	Attachment												
	1. Dump Cylinder												
	2. Hose												
	3. Pump												

Table N.5-3 Cycle Time

1. Name of Driver.....
2. Type of Vehicles.....
3. Capacity.....
4. Car Plate No. .....
5. Date.....

5. Route.....
6. Name of Area.....
7. Dumping Site.....
8. Start Milage.....
   End of Milage.....

	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Inspection														
2. Transfer or Traveling														
3. Loading														
4. Collection														
5. Unloading														
6. Under Repair or Under Service														
7. Rest														

Table N.5-4 Repair Specification

Order No.....

No.1	Name of Machine		Milage Meter	Hr. Km.
No.2	Serial No. Chassi No.		Date of Delivery	
No.3	Number of Machine		Date of Inspection	
No.4	Attachment		Place of Delivery	

Unit Name	After O.H.	Repair Specification	Remarks
Engine		1.Check Water	
		2. Check Oil	
		3. Check Fan Belt Tention	
		4. Clean Air Cleaner	
		5. Clean Fuel Filter or Change	
		6. Valve Adjustment	
		7. Bolt Tighten	
Clutch		1. Clutch Adjustment	
		2. Clutch Overhall	
Universal		1. Check Lubricant	
Joint		2. Change Joint	
		3. Add Gease	
Transmission		1. Check Oil	
		2. Check Leakage	
		3. Change Oil	

Unit Name	After O.H.	Repair Specification	Remarks
Center Bearing		1. Checking Play	
		2. Checking Lubrication	
		3. Tighten Nut	
Differential		1. Checking Oil	
Gear Case		2. Oil Leak	
		3. Noise Checking	
Brake		1. Front Brake Checking	
		2. Rear Brake	
		3. Center Brake	
		4. Leak Brake Oil	
		5. Checking Level Brake Fluid	
Suspension		1. Front Suspension	
System		2. Rear Suspension	
		3. Shock Absorber	
Steering		1. Checking Steering Gear	
System		2. Steering Linkage Checking	
		3. Steering Wheel	
Electrical		1. Battery Water	
		2. Distributor	
		3. High Tension Cable	
		4. Startr Motor	
		5. Fuse Block, Flasher, Horn	

Unit Name	After O.H.	Repair Specification	Remarks
Body		1. Door, Front, Rear	
		2. Lock	
		3. Step, Front, Glass	
P.T.O.		1. Power Take Off	
		2.	
		3.	
Attachment		1. Tilt System	
		2. Ripper System	
		3. Cylinder	
		4.	

2) Management of Workers

. A person in charge : Mr. Udom and Mr. Boonta
. Their duty : Supervisor and Accountant
. Contents of Work :

Every morning before start to work, the supervisor gather collectors and drivers at the court of DCTC. Then, he instructs them the days collection areas, routs and matter to be attended to.

At that time, labour fees are paid to workers and drivers by accountant. And they make a signatures on the working day table. This table is used both as a check sheet of working day and receipt for labour fee. The working day table is shown in Table N.5-5.

Table N.5-5 Working Day Table

Name	Duty	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.	Fee
Mr.Vanly	Driver							1,000
Mr.Sichanh	Driver							1,000
Mr.Tui	Worker							800
Mr.Lai	Worker							800
Mr.Mang	Worker							800
Mr.Tikham	Worker							800
Mr.Siphan	Worker							800
Mr.Somphet	Worker							800
Mr.Sengphoon	Worker							800
Mr.Phong	Worker							800

3) Management of disposal Site

a. Operation of weighbridge computer

. A person in charge : Mr. Boonyou and Mr. Bounsang
. Their duties : Operator
. Contents of Work :

They operate a computer and measure the amount of waste hauled to KM-18.

The daily record is made from all of incoming vehicle data every day.

The incoming vehicle data and daily record are shown in Table N.5-6.

Table N.5-6 Incoming Vehicle Data and Daily Record

DAILY DATA 92. 3.21

184		238
	10	- - -
		3110kg
	11:54	5430kg
185		383
	100	- - -
		3760kg
	11:55	4580kg
186		160
	10	- - -
		3520kg
	12:06	4570kg
187		248
	10	- - -
		4460kg
	12:19	7350kg
188		443
	21	- - -
		4470kg
	13:15	6480kg
189		312
	23	- - -
		6550kg
	14:18	9430kg
190		383
	100	- - -
		3760kg
	16:45	5040kg
191		1208
	22	- - -
		4810kg
	17:07	2330kg

CODE1DAILY 92. 3.21

10	DCTC	
	3	6260kg
21	Chanthabury	
	1	2010kg
22	Sisatanak	
	1	2480kg
23	Saisetha	
	1	2880kg
100	Experiment	
	2	2100kg

Merrs.

CERTIFICATE

	191	92. 3.21
ID. No.	1208	
Code1	22	Sisatanak
Code2		
Code3		
Code4		
Gross Weight		4810kg
Tare Weight	17:07	2330kg
Net Weight		2480kg
Goods Name		
Filing Number		
Measured By		
Remarks		

TCP-150-EX2

4) Contract System

. A person charge : Mr. Pradthana and Mr. Khampan
. Their duty : Fee Collector
. Contents of work :

Fee collectors collect collection fee from residences and shops every month based on ledger for management of collection fee.

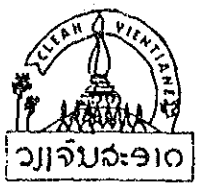
And they sell a extra ticket to residences and shops who have a much amount of waste temporarily.

They should mark contract mark to new contractor's bamboo basket which by green color splay and they should delete contract mark from canceled contractor's bamboo basket by red color splay.

The duty of fee collector is not only collection of fee but also development of new contractor, advice on opinion and request from contractors.

Contract sheet, receipt for collection fee and ledger for management of collection fee are shown in Table N.5-7, N.5-8 and N.5-9 respectively.

Table N.5-7 Contract Sheet



ສັນຍາຜູກພັນເກັບມັດຈຳຂີ້ເຫຍື້ອ

ລະຫວ່າງ : ຜູ້ຮັບເຫມົາ (ຄະນະສຳຫລວດຂີ້ເຫຍື້ອຂອງ ໃຈກາ ແລະ ກອງອານາໄມ ເຫດສະບານ) ກັບເຈົ້າຂອງຂີ້ເຫຍື້ອ (ຜູ້ສັນຍາຈ້າງ)

ຊື່.....

ທັງສອງຝ່າຍ ໄດ້ຕົກລົງກັນເປັນເອກະພາບກັນ ຕາມກຳນົດ ດັ່ງລຸ່ມນີ້:

ກ. ເນື້ອໃນ.....ເກັບຂີ້ເຫຍື້ອ ປະຈຳວັນ

ຂ. ໄລຍະສັນຍາ.....ເດືອນຫນຶ່ງ
ຈາກວັນທີ.....ເດືອນ.....ປີ 1992
ຫາວັນທີ.....ເດືອນ.....ປີ 1992

ຄ. ຈຳນວນມື້ທີ່ໄປເກັບຂີ້ເຫຍື້ອ .....ອາທິດນຶ່ງເທື່ອນຶ່ງຄືວັນ.....

ງ. ລາຄາ.....1.000 ກີບ ຕໍ່ ນຶ່ງເດືອນຕໍ່ນຶ່ງເຮືອ

ຈ. ວິທີເກັບເງິນ.....ຈ່າຍລ່ວງຫນ້າທັງຫມົດນຶ່ງເດືອນ

ສ. ພາຫານະໃສ່ຂີ້ເຫຍື້ອ.....ເຮືອໄມ້ໄຜ່ຂະຫນາດກາງ ຈຳນວນ.....ຫນ່ວຍ.

ວັນທີ....ເດືອນ.....ປີ1992

ຊື່ແລະລາຍເຊັນເຈົ້າຂອງຂີ້ເຫຍື້ອ

ຊື່.....

ລາຍເຊັນ.....

ຊື່ແລະລາຍເຊັນຜູ້ຮັບເຫມົາ

ກອງອານາໄມເຫດສະບານ

ຄະນະສຳຫລວດຂີ້ເຫຍື້ອຂອງ ໃຈກາ

Table N.5-8 Receipt for Collection Fee

ໃບຮັບເງິນ

ເລກທີ 500

ຊື່ແລະນາມສະກຸນ......................................

ເຮືອນເລກທີ..........ເລກທີໜ່ວຍ.........ຊື່ບ້ານ.........

ຈຳນວນເງິນ....................................

ໄດ້ຮັບຈຳນວນເງິນທີ່ແຈ້ງຢູ່ຂ້າງເທິງນີ້ເປັນຄ່າເກັບຂີ້ເຫຍື້ອ

ສຳລັບເດືອນ................

ວັນທີ.....ເດືອນ...... 1992

ກອງອານາໄມເທດສະບານ. ຄະນະສຳຫລວດຂີ້ເຫຍື້ອຂອງໃຈກາ

ໃບຮັບເງິນ

ເລກທີ 500

ຊື່ແລະນາມສະກຸນ......................................

ເຮືອນເລກທີ..........ເລກທີໜ່ວຍ.........ຊື່ບ້ານ.........

ຈຳນວນເງິນ....................................

ໄດ້ຮັບຈຳນວນເງິນທີ່ແຈ້ງຢູ່ຂ້າງເທິງນີ້ເປັນຄ່າເກັບຂີ້ເຫຍື້ອ

ສຳລັບເດືອນ................

ວັນທີ.....ເດືອນ...... 1992

ກອງອານາໄມເທດສະບານ. ຄະນະສຳຫລວດຂີ້ເຫຍື້ອຂອງໃຈກາ

Table N. 5-9 Ledger for Management of Collection Fee

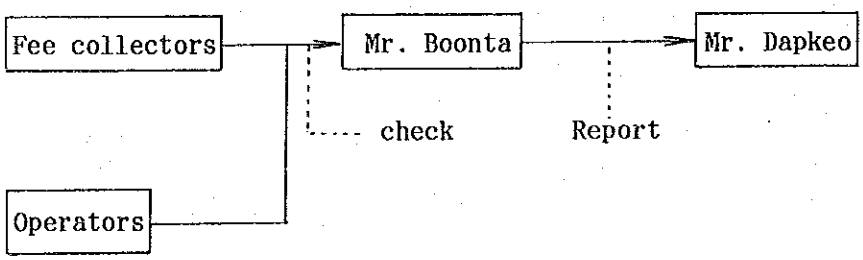
No. ①	Code No. ②	Family Name ③	House No. ④	Nouai ⑤	Ban ⑥	District ⑦	Contract Date ⑧	Contract Month & No. of Baskets												Reception Month											
								Jan ⑨	Feb ⑩	Mar ⑪	Apr ⑫	May ⑬	Jun ⑭	Jul ⑮	Aug ⑯	Sep ⑰	Oct ⑱	Nov ⑲	Dec ⑳	Jan 21	Feb 22	Mar 23	Apr 24	May 25	Jun 26	Jul 27	Aug 28	Sep 29	Oct 30	Nov 31	Dec 32
134	SK-1-01	Mrs. Phoy	N. A.	14	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
135	SK-1-02	Mr. Bounmy	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
136	SK-1-03	Mrs. Keo	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
137	SK-1-04	Mr. Nouphat	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
138	SK-1-05	Mr. Nouphanh	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
139	SK-1-06	Mr. Khamfong	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
140	SK-1-07	Mr. Khammanh	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
141	SK-1-08	Mr. Phansamay	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
142	SK-1-09	Mr. Yen	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
143	SK-1-10	Mr. Vichit	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
144	SK-1-11	Mrs. Khonkham	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
145	SK-1-12	Mr. Viengxay	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
146	SK-1-13	Mr. Khamsene	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
147	SK-1-14	Mr. Bounhome	N. A.	16	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
148	SK-1-15	Mrs. Fong	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
149	SK-1-16	Mrs. Xiou	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
150	SK-1-17	Mr. Khampane	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
151	SK-1-18	Mr. Viangkham	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
152	SK-1-19	Mrs. Naly	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
153	SK-1-20	Mr. Khamphay	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
154	SK-1-21	Mrs. Khamtanh	N. A.	17	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
155	SK-1-22	Mrs. Somphane	N. A.	15	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
156	SK-2-01	Mrs. Vongdeuane	N. A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
157	SK-2-02	Mr. Somphavanh	N. A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
158	SK-2-03	Mr. Boutdy	N. A.	12	Sisavatkang	Chanthabouly	Feb. 26 1992	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

5) Accounting System

. A person in charge : Mr. Boonta
. His duty : Cash Management & Account Sheet keeping
. Contents of Work :

Every day when he receives cash from fee collectors and operator of disposal site, he should check the money and remain of receipts and puts up account. (REV-EXP) Account sheet for SWM is independent from that of DCTC shown in Table N.5-10.

In every evening, he should check the remain of the accounting sheet and cash in a cash box, and if there is some difference between them, he should make a note (uncertain expense, or uncertain revenue) in the accounting sheet.



If cash in a cash box is less than 50,000 kips, he should ask Mr. Dapkeo to withdraw the money from the bank.

If cash in a cash box is more than 100,000 kips, he should go to the bank to deposit the money.

On the end of month, he should sum up the total of revenue and expenditure, and sub-total of each category.

In a week of new month it is expected to make monthly report shown in Fig. N.5-2 and Table N.5-11 and N.5-12.

Table N.5-10 Accounting Sheet

No. 1

Month	Date	Receipt No.	Code	Item	Revenue	Expenditure	Balance
Feb.	17		R-1	Collection Fee	21,000		21,000
Feb.	17	1	E-7	Stationary		1,200	19,800
Feb.	18		R-1	Collection Fee	52,000		71,800
Feb.	18		R-1	Collection Fee	63,000		134,800
Feb.	20	2	E-7	Opening Bank Account		1,000	133,800
Feb.	22		R-1	Collection Fee	1,000		134,800
Feb.	22		R-1	Collection Fee	177,000		311,800
Feb.	24		R-3	Unclear	100		305,600
Feb.	24	4	E-2	Labour Fee		6,200	306,000
Feb.	24		R-2	Tipping Fee	1,810		306,600
Feb.	24	001	R-2	Tipping Fee	400		308,410
Feb.	24	002	R-2	Tipping Fee	600		308,510
Feb.	24	003	R-2	Tipping Fee	800		309,310
Feb.	24	004	R-2	Tipping Fee	800		310,110
Feb.	25	3	E-7	Stationary		2,350	310,610
Feb.	25	4	E-2	Labour Fee		6,200	304,410
Feb.	25	005	R-2	Tipping Fee	500		304,910
Feb.	25	006	R-2	Tipping Fee	500		305,510
Feb.	25	007	R-2	Tipping Fee	600		306,010
Feb.	25	008	R-2	Tipping Fee	500		306,810
Feb.	25	009	R-2	Tipping Fee	800		307,610
Feb.	25	010	R-2	Tipping Fee	800		308,410
Feb.	25	011	R-2	Tipping Fee	800		309,210
Feb.	25	012	R-2	Tipping Fee	800		306,860
Feb.	26	013	R-2	Tipping Fee	800		307,660
Feb.	26	014	R-2	Tipping Fee	500		308,160
Feb.	26	015	R-2	Tipping Fee	800		308,960
Feb.	26	016	R-2	Tipping Fee	400		309,360
Feb.	26	018	R-2	Tipping Fee	800		310,160
Feb.	26	019	R-2	Tipping Fee	800		310,960
Feb.	26	4	E-2	Labour Fee		5,600	305,360
Feb.	27	020	R-2	Tipping Fee	500		305,860
Feb.	27	021	R-2	Tipping Fee	800		306,660
Feb.	27	022	R-2	Tipping Fee	800		307,460
Feb.	28	023	R-2	Tipping Fee	500		307,960
Feb.	28	024	R-2	Tipping Fee	800		308,760
Feb.	28	025	R-2	Tipping Fee	800		309,560
Feb.	28	026	R-2	Tipping Fee	400		309,960
Feb.	28	027	R-2	Tipping Fee	500		310,460
Feb.	28	028	R-2	Tipping Fee	400		310,860
Feb.	28	029	R-2	Tipping Fee	500		311,360
Feb.	28	030	R-2	Tipping Fee	800		312,160
Feb.	28	031	R-2	Tipping Fee	500		312,660
Feb.	29	032	R-2	Tipping Fee	500		313,160
Feb.	29	033	R-2	Tipping Fee	800		313,960
Feb.	29	035	R-2	Tipping Fee	500		314,460
Feb.	29	036	R-2	Tipping Fee	800		315,260

Table N. 5-11 Monthly Report on Revenue and Expenditure

1.Revenew	402,110
Collection Fee:	314,000
Tipping Fee:	88,010
Oters:	100
2.Expenditure	521,804
Personnel Ex.:	384,384
Administration:	84,084
Cleansing Service:	210,300
KM18-DS:	90,000
Fuel & Lubricant for Vehicle:	100,200
Maintenance for Vehicle:	28,230
Utility for Inspection Building:	
Others (Administrative Expenditure etc.):	8,990
3.Balance	-119,694
Total Revinew:	402,110
Total Expenditure:	521,804

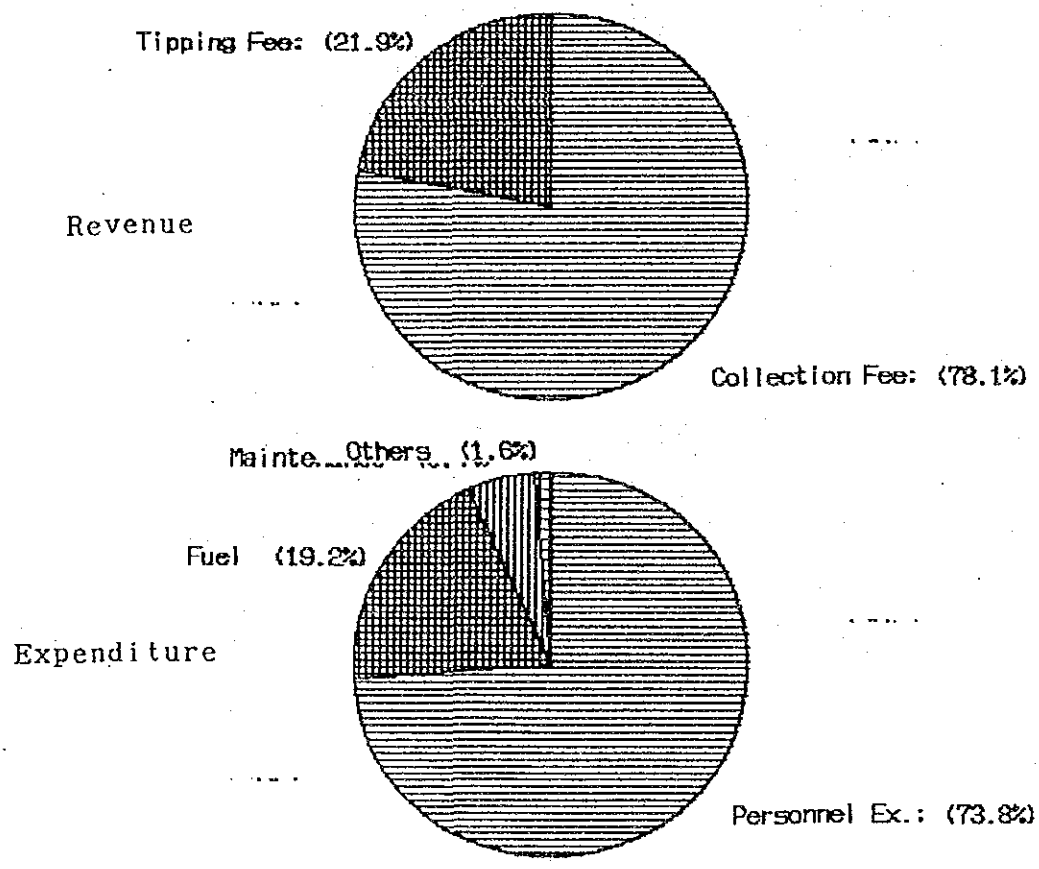


Fig. N. 5-2 Monthly Report on Revenue and Expenditure

Table N.5-12 Cost Analysis Sheet

Total		Collection		Disposal		Others	
Revenue	328,200	R-1	314,000	R-2	14,100	R-3	100
Expenditure							
Personnel	275,384	E-2,E-2-1	145,500	E-3,E-3-1	26,800	E-1,E-1-1	103,084
Fuel & Lubrica	54,550	E-4	50,000	E-6	0	E-7	4,550
Maintenance	0	E-5	0				
Rental	840,000		0	E-8	840,000		
Depreciation	360,429	E-9	360,429				
Sub-total	1,530,363		555,929		866,800		107,634
Administration			42,058		65,576		
Disposal fee			39,663				
Total	1,530,363		637,650		932,376		
Balance	**********		-323,650		-918,276		
excluding Depr	-841,734		36,779		-918,276		
Volume treated			19.38		455.57		
Unit cost			32,902		2.047		

Code for Revenue

R-1: Collection Fee for Collection Service
R-2: Tipping Fee at KM18-DS
R-3: Others

Code for Expenditure

E-1: Personnel Expenditure for Administration
E-1-1: Personnel Expenditure for Administration (Over Time)
E-2: Personnel Expenditure for Cleansing Service

E-2-1: Personnel Expenditure for Cleansing Service (Over Time)
E-3: Personnel Expenditure for KM18-DS
E-3-1: Personnel Expenditure for KM18-DS (Over Time)
E-4: Fuel & Lubricant for Vehicle
E-5: Maintenance for Vehicle
E-6: Utility for Inspection Building
E-7: Others (Administrative Expenditure etc.)c
E-8: Rental for Buldozer
E-9: Depreciation of Collection Vehicles

6) Management of Amount of Collection Waste

. A person in charge : Mr. Buntong
. His duty :
. Contents of Work :

Amount of waste hauled to KM 18-DS is measured by weight bridge installed by JICA.

The measured data is compiled as a daily record every day.

The daily record is imputed in the computer as a monthly record twice a week in the DCTC office.

The daily movement according to amount of waste hauled to KM 18-DS and hauling ratio by DCTC, private and directly are made a graphs.

Data for amount of waste and number of incoming vehicles is shown in Table N.5-13 and the daily movement according to amount of waste and hauling ratio by each sectors are illustrated in Fig. N.5-3 and N.5-4 respectively.

Table N.5-13 Data for Amount of Waste Hauled to KM18-DS and Number of Incoming Vehicles

DATE	Amount of Waste Hauled to KM18-DS (ton)						Number of Incoming Vehicles					
	DCTC	Private-CRC	Private-ISC	Private-SWM	Directly	Total	DCTC	Private-CRC	Private-ISC	Private-SWM	Directly	Total
Jan. 1 Wed	-	-	-	-	-	0	-	-	-	-	-	0
2 Thu	9.12	2.25	3.9	0	1.29	16.56	4	1	1	0	1	7
3 Fri	8.25	0	2.34	0	10.14	20.73	3	0	1	0	3	7
4 Sat	16.66	3.83	2.38	0	1.23	24.1	5	2	1	0	2	10
5 Sun	-	-	-	-	-	0	-	-	-	-	-	0
6 Mon	4.34	1.71	6.55	0	1.02	13.62	2	1	1	0	1	5
7 Tue	5.21	2.44	3.8	0	3.41	14.86	4	1	1	0	3	9
8 Wed	5.58	2.82	3.46	0	8.87	20.73	2	1	1	0	4	8
9 Thu	1.38	3.52	3.18	0	5.45	13.53	1	1	1	0	5	8
10 Fri	8.02	2.6	3.52	0	5.72	19.86	3	1	1	0	4	9
11 Sat	3.25	2.6	0	0	5.64	11.49	1	1	0	0	4	6
12 Sun	3.14	0	3.98	0	0	7.12	1	0	1	0	0	2
13 Mon	5.21	5.58	2.09	0	5.45	18.33	2	2	1	0	4	9
14 Tue	6.46	2.48	3.91	4.11	10.68	27.64	3	2	1	1	4	11
15 Wed	5.87	2.52	2.87	0	0	11.26	3	1	1	0	0	5
16 Thu	10.81	5.03	4.72	3.19	2.63	26.38	4	2	1	1	2	10
17 Fri	9.4	2.7	2.32	0	9.09	23.51	4	1	1	0	2	8
18 Sat	4.48	4.1	3.54	0	4.32	16.44	3	2	1	0	2	8
19 Sun	-	-	-	-	-	0	-	-	-	-	-	0
20 Mon	6.21	1.14	2.38	0	2.7	12.43	2	1	1	0	2	6
21 Tue	5.23	2.38	4.03	0.05	2.5	14.19	3	2	1	1	3	10
22 Wed	8.35	5.89	0	0	10.78	25.02	4	2	0	0	5	11
23 Thu	5.52	5.33	4.09	3.49	6.8	25.23	3	2	1	1	3	10
24 Fri	6	4.26	2.99	0	17.6	30.85	3	2	1	0	6	12
25 Sat	7.93	4.32	0	0	4.5	16.75	3	2	0	0	4	9
26 Sun	0	3.35	0	0	6.43	9.78	0	1	0	0	2	3
27 Mon	4.16	5.46	4.69	0	10.28	24.59	2	2	1	0	7	12
28 Tue	1.47	4.81	3.41	3.88	5.38	18.95	1	2	1	1	2	7
29 Wed	10.69	5.8	4.39	3.87	5.71	30.46	4	2	1	1	6	14
30 Thu	11.07	5.61	3.1	0	3.37	23.15	4	2	1	0	4	11
31 Fri	6.82	3.45	0	0	2.33	12.6	3	1	0	0	2	6
Total	180.63	95.98	81.64	18.59	153.32	530.16	77	40	23	6	87	233
Average(per day)	6.45	3.43	2.92	0.66	5.48	18.93	2.75	1.43	0.82	0.21	3.11	8.32
Average (per working day)	6.69	3.69	3.55	3.10	5.90		2.85	1.54	1.00	1.00	3.35	

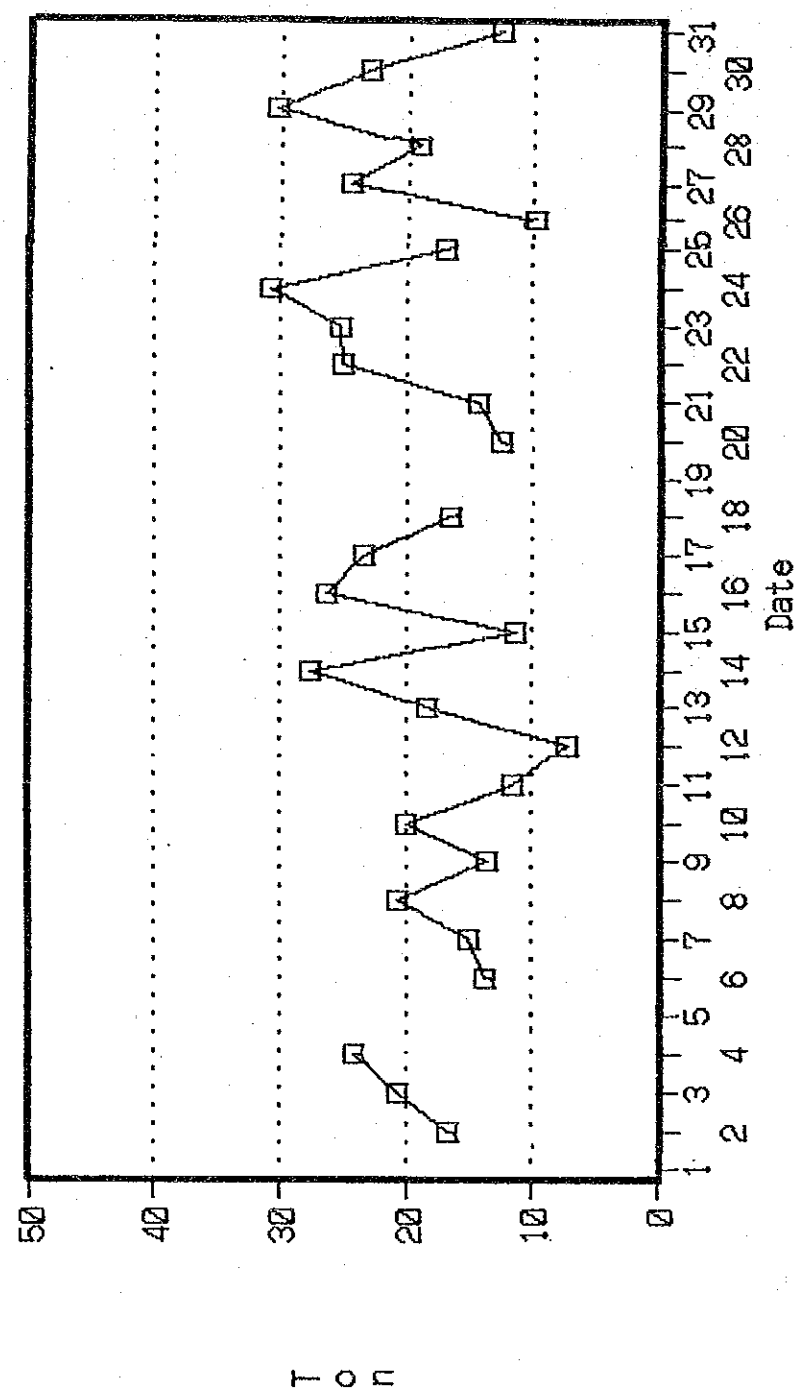


Fig. N.5-3 Amount of Waste Hauled to KM18-DS (January,1992)

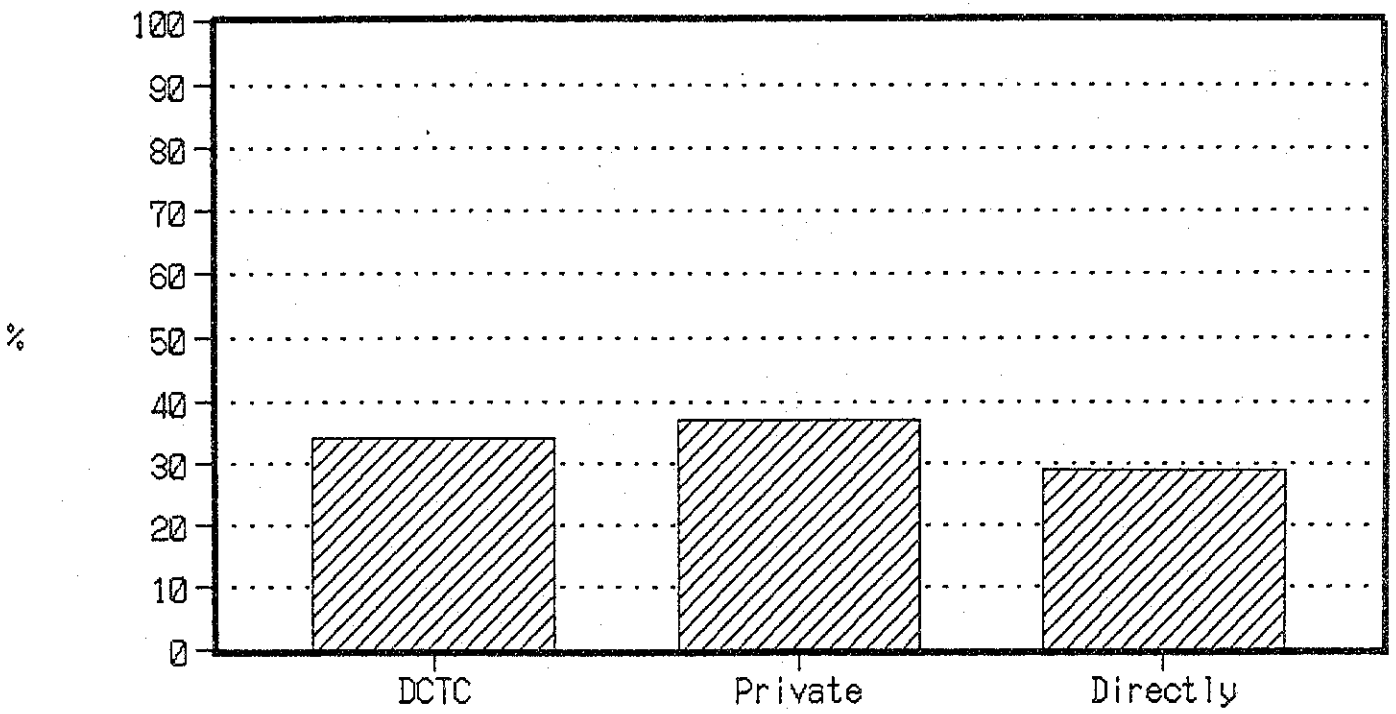


Fig. N.5-4 Amount of Waste Hauled by DCTC, Private and Directly (January,1992)

N.5.2 Project Implementation Body and Schedule

1) Project Implementation Body

Solid waste management is currently conducted by DCTC in Vientiane Municipality which is responsible for collection/ cleansing and disposal. For the successful project implementation, however the Urban Services Department should be established. In view of the fact that financial assistance from the State Government is not expected to thoroughly support the project implementation, Vientiane Municipality will provide the necessary funds and will supervise the implementation of the Project.

2) Implementation Schedule

A project implementation plan is proposed, as shown in Fig. N.5-5.

a. Implementation conditions

Implementation conditions for the Phase I Improvement Project are as follows:

- Design Target Year : 1995
- Service Commencement Year : 1995
- Subject Area : entire Vientiane urban area

b. Preparatory period

The following must be conducted in 1993.

- acquisition of investment funds and preparation of repayment plan;
- confirmation of facility construction site;
- preparation of detailed design and specifications for facilities as well as equipment/material; and
- selection of contractor (tender, evaluation and contract)

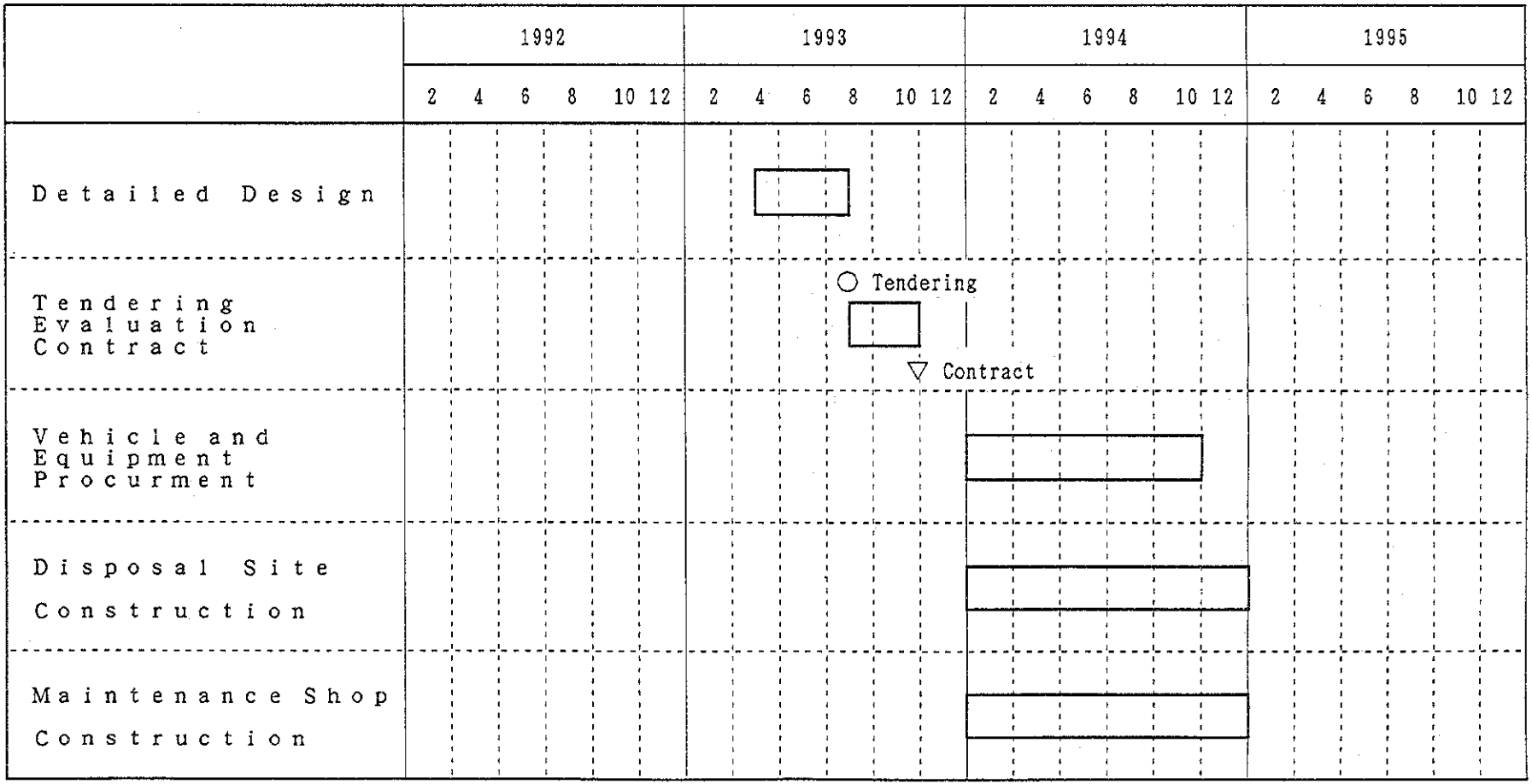


Fig. N.5-5 Implementation Schedule

c. Construction schedule

The Project is mainly divided into equipment procurement work and facility construction work, of which periods are proposed as follows:

- equipment/material procurement : 8 months after completion of contract
- maintenance shop construction : 12 months after commencement of the construction
- disposal site construction : 12 months after commencement of the construction

N.5.3 Financial Plan

The financial plan for the project implementation is described below based on the financial evaluation results.

1) Required Fund/Capital

The investment cost and annual expenditure have been estimated based upon the project cost described in section 11.3 making the additional assumptions:

a. The costs for engineering services and contingencies, which were not included in the financial analysis, shall be included in the financial plan.

b. The investment and operation costs are estimated to increase at the rate of 3.0% per year, while a 5% annual increase in labour cost is assumed. The increase after 2000, however, will not be taken into consideration as the charging system will be revised and improved by then.

c. Nominal interest rates ranging from 6% for long term loans and 11.5% for short term loans will be adopted. The interest rate for deposits will be 9.5%.

2) Financial Resources

The capital required for the implementation of the project will be appropriated from the VM budget, internal fund reserved by profit and depreciation, and foreign aids. Long term foreign loan is not considered in this Feasibility Study Period due to the insufficient foreign currency holdings and the urgency for the improvement of SWM. Long term foreign loans will be taken into consideration, however, through the formulation of a cash flow after the construction of the final disposal site in 1997. The loan condition is assumed to be 20 years repayment with 3 years grace period. Furthermore, the repayment

of long term loan and its interest is assumed to be subsidized by VM budget.

The appropriation of financial sources is as follows:

Table N.5-14 Financial Resources for Investment

(unit : million Kips)

year	1994	1995	1996	Total
Project Budget of VM	-	81	83	164
Internal Fund Reserves	-	81	83	164
Grant	2,451	0	0	2,451
Total	2,451	162	166	2,779

If foreign aids are difficult to acquire, foreign loans shall be considered. However, the repayment terms to be adopted shall be similar to the mean external public borrowing in 1989, that is, a 40 years repayment term with a 20 years grace period, and a 0.6% interest rate.

The source of SWM operation cost will be the collection fees and the ordinary budget of VM.

The appropriation of finances from the 2 sources is shown in Table N.5-15.

Table N.5-15 Composition of Revenue

(unit : million Kips)

year	1995	1996	1997	Total
Fee Collection				
Basic Fee	241	311	380	932
Extra Fee	65	85	106	256
Special Fee	14	14	15	43
Tipping Fee	2	2	2	6
Sub-Total	322	412	503	1,237
VM Current Budget	129	133	137	399
Total	451	545	640	1,636

The fee tariff will be reviewed and increased in 1998. At the same time, it is necessary to examine the introduction of a new tax system for the municipality or the increase of the present land tax ratio, because it seems to be very difficult to increase the collection service ratio from 50% by 1995 to 100% by 2000 with the proposed collection fee system due to the existence of poor households.

3) Expenditures and Revenues

The cash flow for 2000 is made based on the above-mentioned assumption and shown in Table N.5-17. The cross-subsidy, however, is not taken into consideration.

The table clearly shows that the balance will be in black figures in 1997 and then in red in 1998 due to the interest rates of foreign loans made for the construction of a full scale final disposal site (level 3) in 1997. By 2000, however, the balance will be in black again.

A total debt of 2,412 million kips will be accumulated in 2000. Since the internal fund reserve in 2000 will be 2,069 million kips, self-finance can be established completely in 2005, if VM covers half of the new investment.

The allocation of VM budget is as follows:

Table N.5-16 Allocation of VM Budget for SWM (in case of Grant)

(unit : million Kips)

year	1995	1996	1997	1998	1999	2000	Total
for investment*1	81	83	115	126	307	0	712
for public burden	129	133	137	143	158	164	864
for repayment of loan						151	151
for interest of loan				154	154	154	462
Total (A)	210	210	252	423	619	469	2,189
VM budget (B)*2	5,550	6,003	6,492	7,021	7,592	8,211	
A/B x 100 (%)	3.8	3.6	3.9	6.0	8.2	5.7	

Note:

*1 : The investment for the purchase of collection vehicles is assumed to be subsidized by half from VM budget.

*2 : VM budget is assumed to increase in accordance with the increase ratio of the GRDP plus inflation ratio of 3%.

Table N.5-17 Balance Sheet and Cash Flow

Balance Sheet

Unit : million Kips

Year	1994	1995	1996	1997	1998	1999	2000
Revenue							
Fee collection							
Basic fee		241	311	380	539	623	706
Extra fee		65	85	106	126	146	167
Special fee		14	14	15	25	26	27
Tipping fee		2	2	2	3	3	3
Budget from VM		129	133	137	143	158	164
Others		0	13	33	56	94	126
Sub total(A)	0	451	558	672	893	1050	1193
Expense							
Personnel							
Expenditure		43	56	69	96	114	135
Maintenence		37	45	53	61	69	78
Fuel & Others		152	169	187	205	223	241
Depreciation		305	325	347	489	522	557
Interest		0	0	0	154	154	154
Sub total(B)	0	536	596	656	1006	1082	1164
Balance	0	-86	-38	16	-113	-32	29

Cash Flow

Unit : million Kips

Year	1994	1995	1996	1997	1998	1999	2000
Balance	0	-86	-38	16	-113	-32	29
Depreciation	0	305	325	347	489	522	557
Sub total(C)	0	219	287	363	376	489	586
Money Demand							
Investment	2451	161	166	2792	252	615	0
Loan							
Long Term	0	0	0	0	0	0	151
Short Term	0	0	0	0	0	0	0
Sub total	2451	161	166	2792	252	615	151
Money Supply							
Budget from VM							
for Investment	0	81	83	115	126	307	0
for Debt serv.	0	0	0	0	154	154	304
from Int.Fund	0	81	83	115	126	307	0
Foreign Aids	2451	0	0	0	0	0	0
Long Term Loan	0	0	0	2563	0	0	0
Short Loan	0	0	0	0	0	0	0
Sub total	2451	161	166	2792	406	769	304
Surplus of	0	138	204	248	404	336	740
Money							
Fund Reserves	0	138	342	590	994	1330	2069
Total of Debt	0	0	0	2563	2563	2563	2412

Note : Debt serv. includes repayment and interest for the long term loan for full scale disposal site(level 3)

N.5.4 Establishment of a Monitoring System

1) Necessity for the Establishment of a Monitoring System

Once the Municipality decides to commit itself to achieving Basic Plan targets, it will be important to establish a system within the Municipality to monitor closely the progress of improvements. Data will be obtained through such monitoring for self-evaluation of the Municipality's performance, without which the Municipality will be unable to assess progress.

2) Personnel Responsible for Monitoring

In the Research & Development Section of the new department, i.e. USD to be responsible for SWM, the following personnel should be involved in monitoring operations.

Table N.5-18 Personnel to be Involved in Monitoring Operations

Action Required	Personnel Responsible
Identification of useful indicators	Technician
Data-collection & compilation	Technician
Data-analysis, Evaluation of performance and formulation of action plans	Manager
Review of Basic Plan Targets based upon the performance evaluation	Manager, Deputy Director and Director

3) Indicators to be Used

a. Selection of indicators

Selection of indicators are related to the Basic Plan targets. Useful indicators include the following;

Table N. 5-19 Principal and Supporting Indicators

Basic Plan Target	Principal Indicators	Supporting Indicators
a. Expansion of collection services	• Percentage in terms of population • Amount of collection waste • Number of resistances contracted with DCTC	• Percentage in terms of area • Waste measured by weight bridge • Ledger for management of collection fee
b. Cleansing activity through public cooperation	• Percentage in terms of Bans	• Percentage in terms of area
c. Upgrading of the Standard	• Standard of sanitary landfill	• Amount of Scattering waste • Number of complaint by residents
d. Strengthen of Organization	• Collection services efficiency	• Number of personel in USD • Unit cost of services per ton
e. Securing financial resources for SWM	• Collection fee • Tipping fee • Revenue and expenditure	• Ledger for management of collection fee • Accounting sheet

The above table shows some useful indicators. There may be other indicators. It is important to distinguish principal indicators from supporting indicators, as shown in the above table. Whether a particular indicator should be treated as a principal or supporting indicator depends on the purpose of the evaluation.

b. Definitions of indicators

One of the most serious problems with respect to performance-indicators arises when considering ways to measure performance, i.e. the definition of indicators. For example, the unit-collection-cost differs greatly depending on whether or not to include certain indirect costs such as administration-costs, assumed office-rent, cost of stand-by vehicles and insurance premium paid, etc.

In view of the above, it is important for the Municipality to establish the precise definitions of indicators, and use indicators of the same definitions over a long period. This will enable the Municipality to compare past performance with the present using the same criteria.

It will be also very useful for Lao P.D.R. to develop definitions of indicators to be used by all Local Governments. The development of such definitions will enable inter-municipal comparisons on the basis of similar criteria.