

b. Preparation of an educational program for the primary school

The Study Team, with the cooperation of DCTC, conducted a solid waste education program in the 3 primary schools of each selected village in the collection experiment. During the solid waste education, the teachers were observed to pay little attention, but the pupils were quite interested in the details and the drawing boards prepared by the Study Team. The content of the program covers all the necessary information regarding solid waste management for the pupils in the primary school.

The drawing boards are shown in Fig. 9.3-2, 9.3-3, 9.3-4, 9.3-5, 9.3-6, 9.3-7, 9.3-8 and 9.3-9. An educational pamphlet was also prepared by the Study Team both in Lao and English and is in Appendix K, the Supporting Report (3).



Fig. 9.3-2 One of the Drawing Boards prepared by the Study Team for Education Program

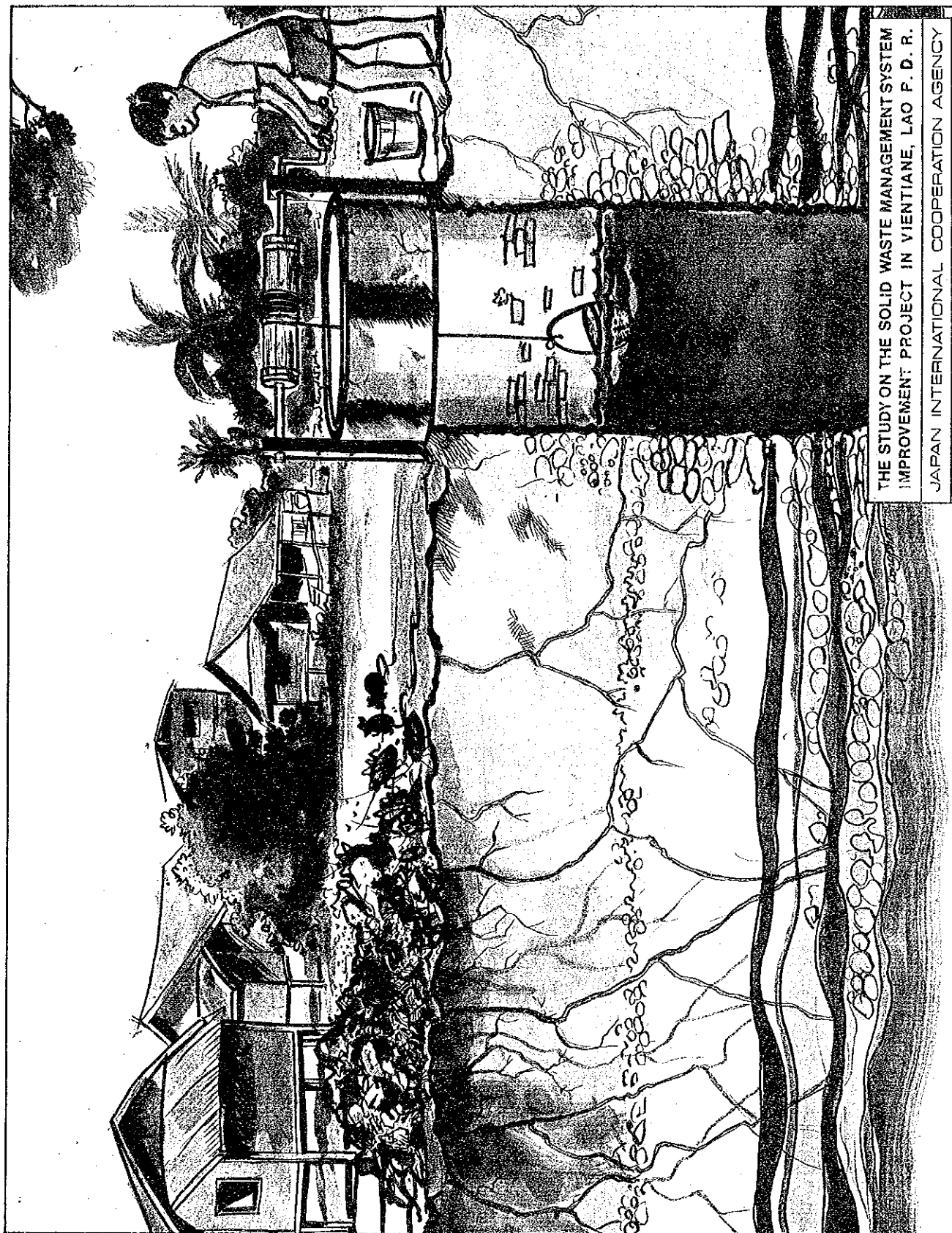


Fig. 9.3-3 The Drawing Board prepared by the Study Team for Education Program

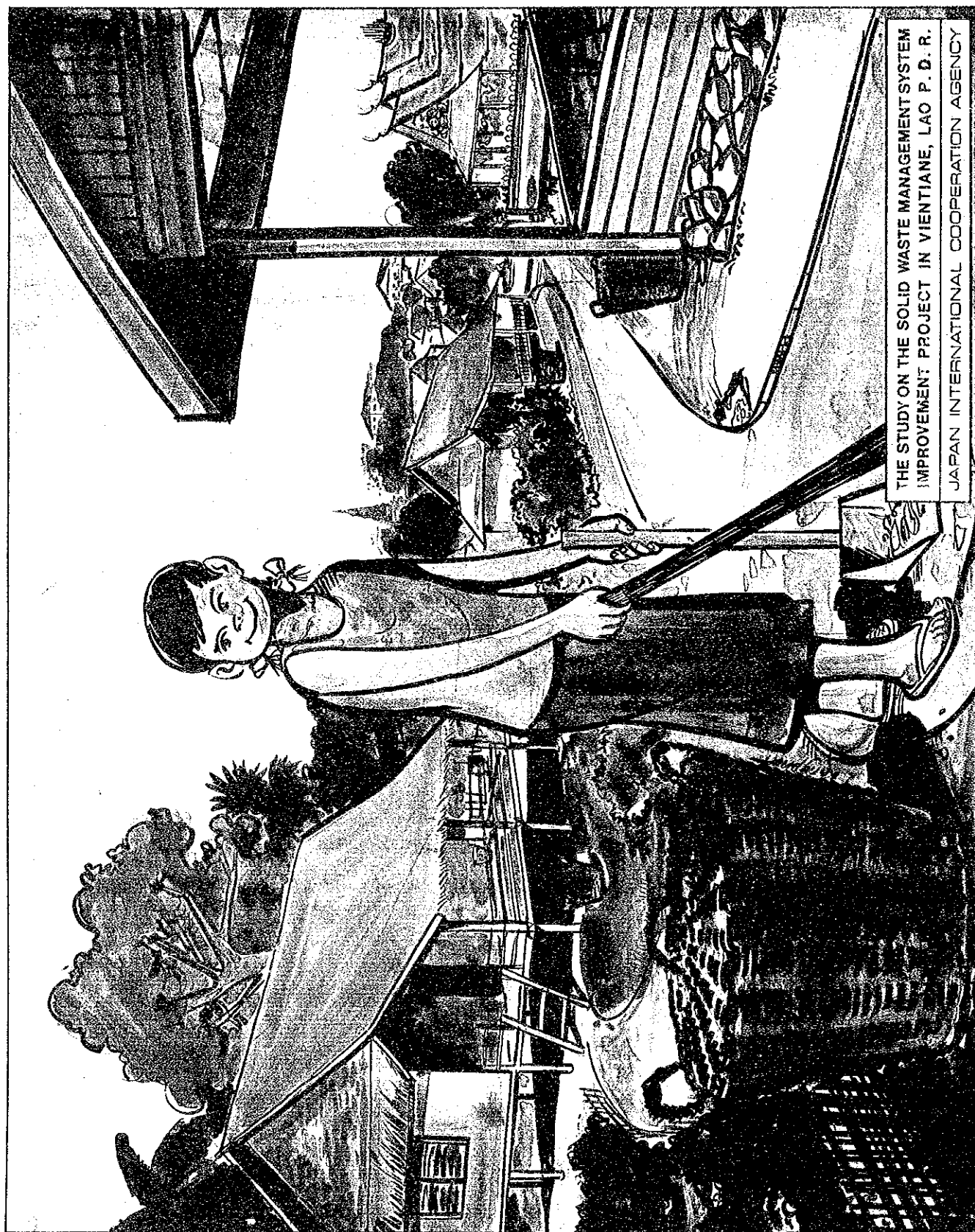


Fig. 9.3-4 The Drawing Board prepared by the Study Team for Education Program

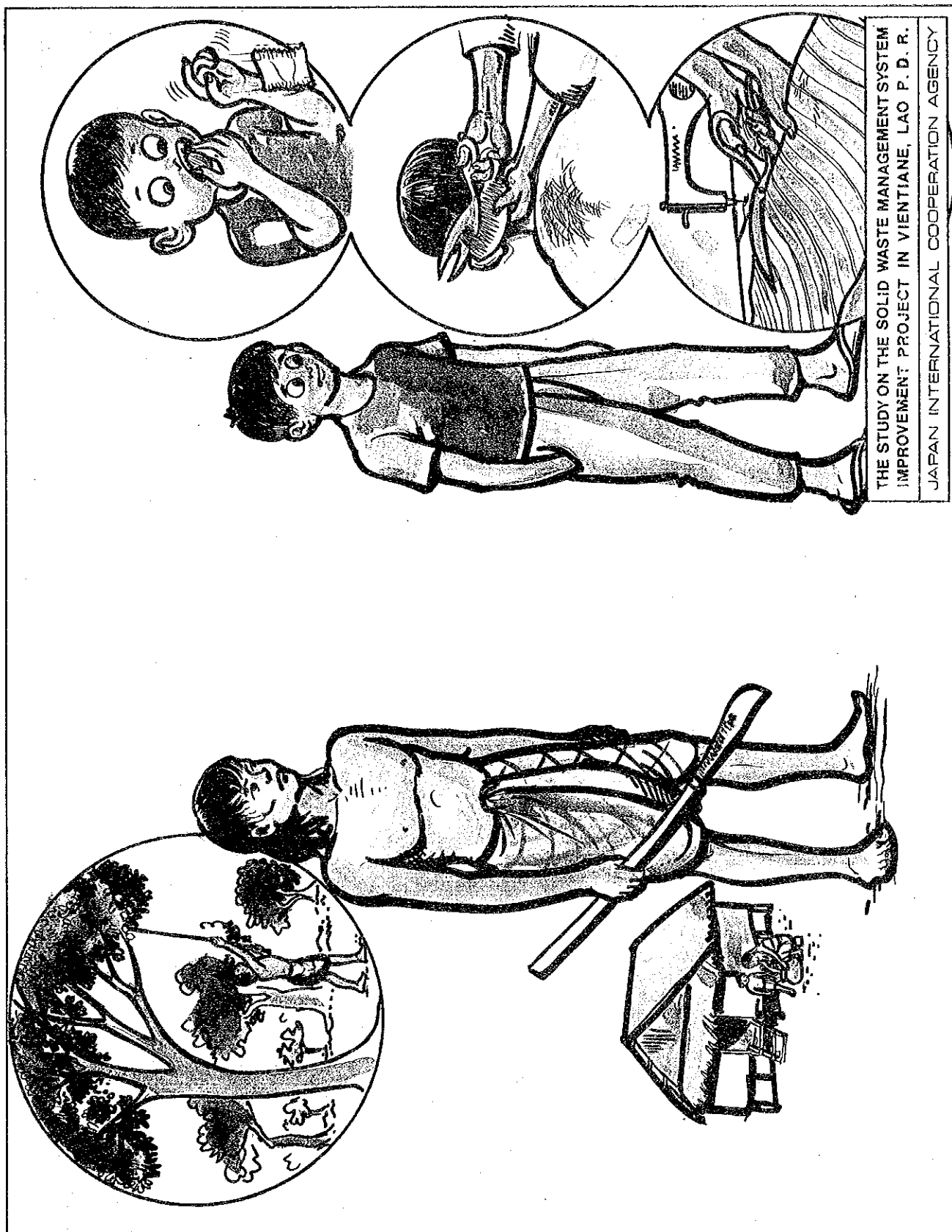


Fig. 9.3-5 The Drawing Board prepared by the Study Team for Education Program





Fig. 9.3-6 The Drawing Board prepared by the Study Team for Education Program

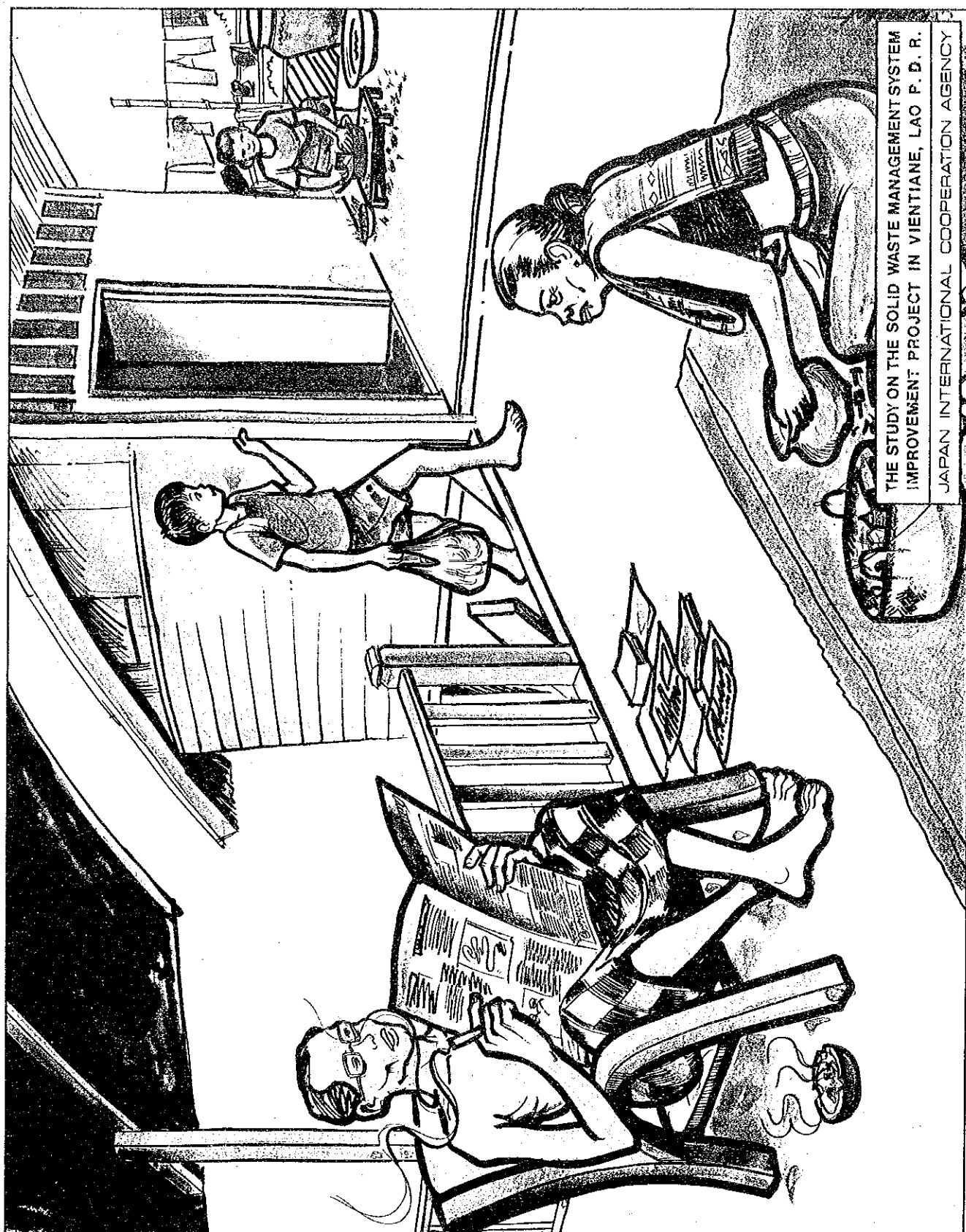


Fig. 9.3-7 The Drawing Board prepared by the Study Team for Education Program

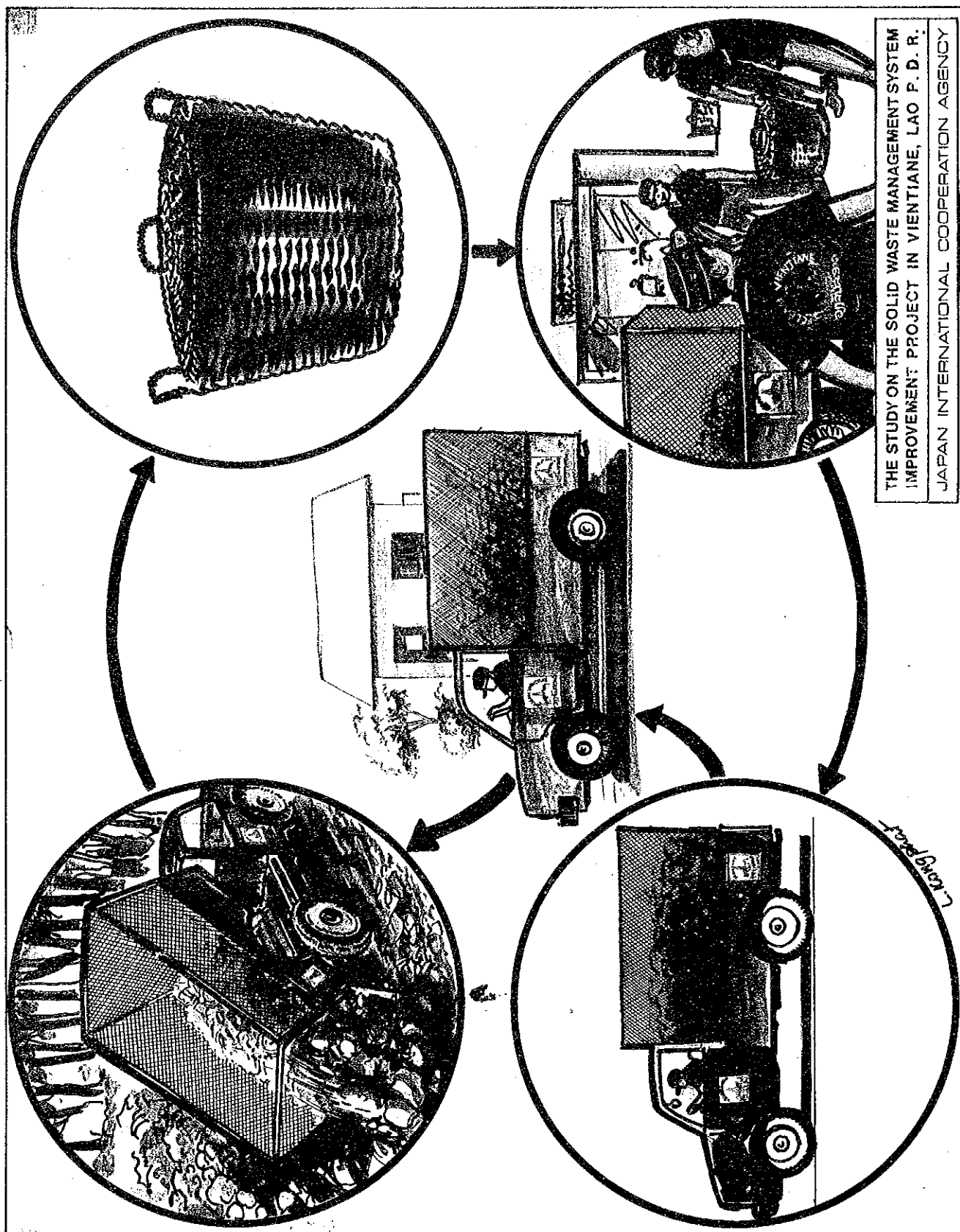


Fig. 9.3-8 The Drawing Board prepared by the Study Team for Education Program





Fig. 9.3-9 The Drawing Board prepared by the Study Team for Education Program

# CHAPTER 10

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## EXECUTION OF PILOT PROJECT

## CHAPTER 10      EXECUTION OF PILOT PROJECT

### 10.1 Purpose of the Pilot Project

There are many improvement measures stated in the Basic Plan. In terms of the technical system for the Basic Plan, the following two are the main objectives:

- a. Extension of collection service to the whole population of the Vientiane urban area; and
- b. Execution of sanitary landfill for disposal of solid waste collected.

In order to examine the workability of the proposed Basic Plan and to make the Plan more practical, a pilot project consisting of collection experiment and experiment on sanitary landfill operation was carried out for one month from the middle of February.

After the preparation of the draft plan, various meetings with the organization and persons concerned in the project have been held in February 1992 in order to concretize and strengthen the draft plan. After the modification of the draft plan, both collection and sanitary landfill operation experiments have been carried out from the end of February.

## 10.2 Collection Experiment

### 10.2.1 Objective

As clearly described in the previous section, the objective of the collection experiment is to examine the workability of the proposed collection plan in the Basic Plan. The main objectives of the proposed collection plan in the Basic Plan are described as follows:

- a. Extension of collection service to the whole population of the Vientiane urban area;
- b. Establishment of a self-sustainable collection system by the Beneficiary-Pay-Principle under which service recipients pay waste collection fees;
- c. Establishment of an efficient and reliable collection system under which regular services can be provided. In concrete terms, the curb and bell collection for the residential and commercial area are proposed; and
- d. Establishment of public cooperation for cleaning-up roads, drains and public areas.

In order to examine the proposed collection plan, the following items were studied in the collection experiment:

- strategy and tactics for the extension of collection service;
- strengthening of the present cleansing section;
- discharge method;
- collection method;
- determination of collection fee and its payment method;
- administration system of collection vehicle;
- administration system of labourers; and
- enhancement of community consciousness on environmental and sanitary hygiene.

### 10.2.2 Plan

#### 1) Outline of the Experiment

Outline of the collection experiment is shown in Fig. 10.2-1

The experiment consists of three major stages.

- a. Planning stage .... Planning for storage, discharge, collection and haulage methods based on the Basic Plan
- b. Execution stage
  - i. preparation work ... To hold a meeting with the residents to explain the details of the project, contract, fee collection, marking, CCS (Community Consciousness Survey) and detail design of collection method, etc.
  - ii. implementation .... Observation, T&M study, and CCS.
- c. Evaluation stage ..... Evaluation of proposed collection system and handing over of the collection experiment to DCTC.

#### 2) Plan of the Collection Experiment

##### a. Selection of experimental areas

Five candidate areas for the experiment were selected according to the following procedure:

- i. Among the 96 Bans in the Study area, 33 Bans, where the community consciousness survey (CCS) had been carried out, were chosen as candidate experimental sites.

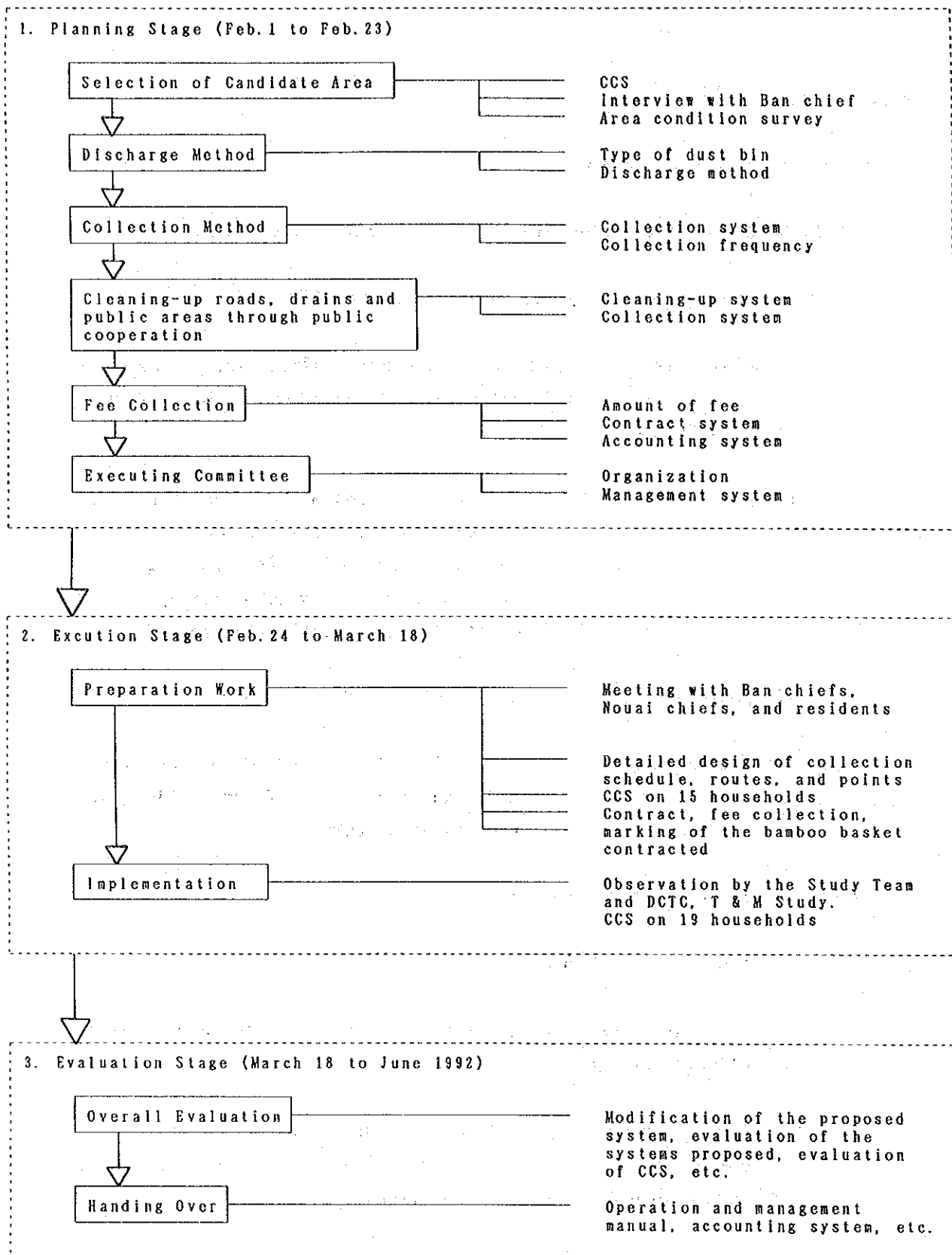


Fig. 10.2-1 OUTLINE OF EXPERIMENT



- ii. Among the foregoing 33 Bans, 23 Bans were selected as candidates because they are not covered by collection services.
- iii. Based on the area condition survey conducted by the Study Team, 23 Bans were reduced to 14 Bans.
- iv. Among the 14 Bans, 5 Bans were selected according to the interviews with the Ban Chief which showed their strong demands for collection services.

Candidate sites for the experiment are shown in Fig. 10.2-2.

b. Area condition

Area conditions are shown in Table 10.2-1.

c. Discharge method

i. dust bins for waste discharge

The use of a bamboo basket for discharge shall be adopted because of its general use and cheapness. And any kind of lid shall be used to prevent the scattering of waste.

Contracted bamboo baskets shall be sprayed in green to distinguish them from others.

ii. discharge place

Collection service recipients shall be responsible for putting their dust bins in the main roads and fixed collection points according to collection routes.

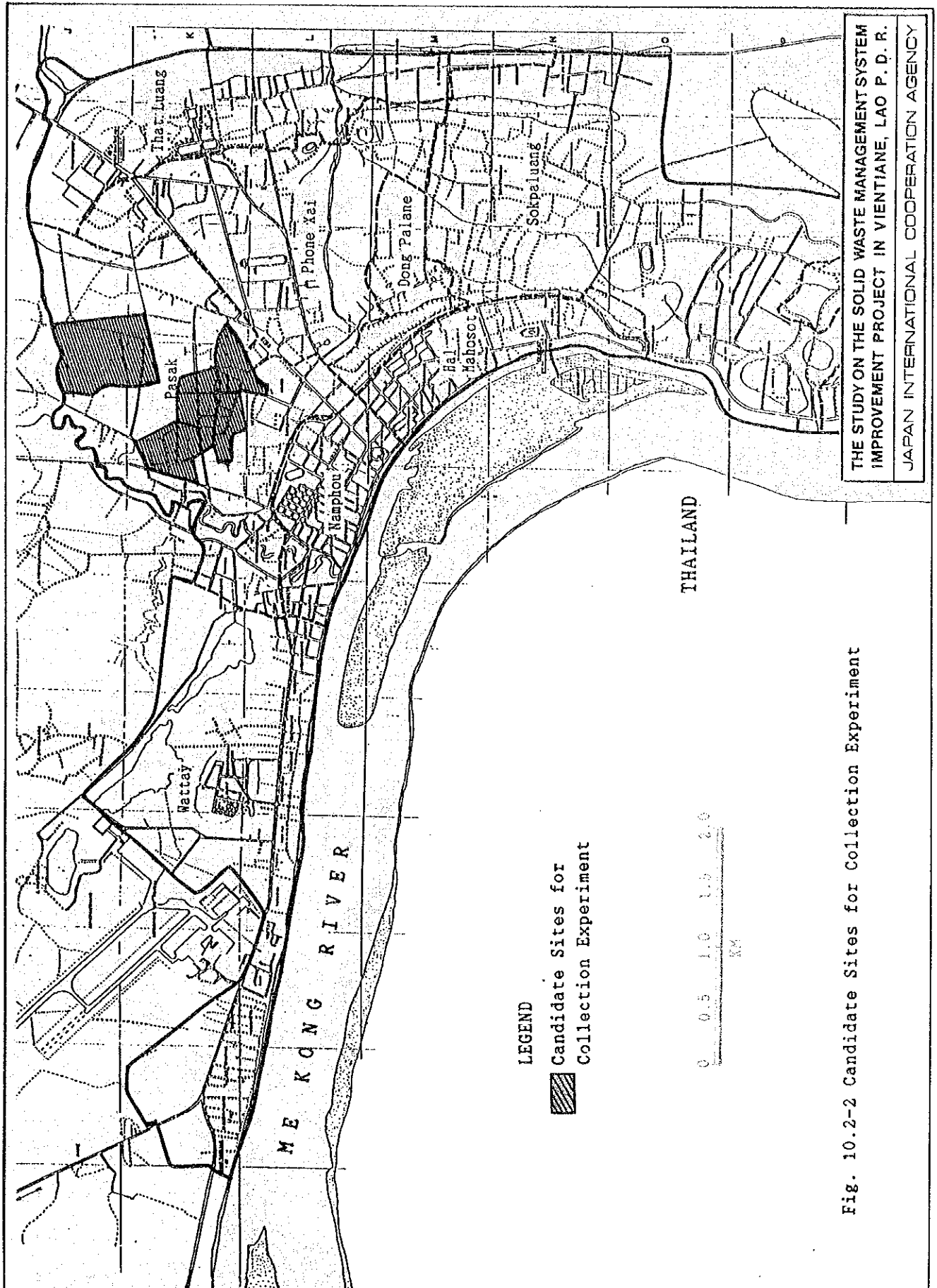


Fig. 10.2-2 Candidate Sites for Collection Experiment

Table 10.2-1 Area Condition

...1

Items \ Bans	Sisavath Tay	Sisavath Kang	Sisavath Neua	Dong Mieng	Thong Sang Nang
1. Population	1,922	1,387	1,006	2,191	2,028
Number of Families	358	276	174	382	333
Area(ha)		42		30	48
Population density		102.7		73.3	42.3
2. Characteristic of Ban					
Number of residences	292 (79.5%)	253 (90.3%)	142 (80.2%)	330 (34.8%)	294 (86.4%)
Number of shops	66 (18%)	23 (8.2%)	32 (18.0%)	52 (13.3%)	39 (11.4%)
Number of public institutions (offices, markets, temples schools)	6 (1.6%)	4 (1.4%)	0 (0.0%)	5 (1.2%)	3 (0.8%)
Number of companies and factories	3 (0.7%)	0 (0.0%)	3 (1.6%)	2 (0.4%)	4 (1.0%)
Total	367 100%	280 100%	177 100%	389 100%	340 100%
3. Race					
Laotian	1,829 (95.1%)	1,305 (94%)	960 (95.4%)	2,081 (95%)	2,022 (99.7%)
Vietnamese	53 (2.7%)	20 (1.4%)	12 (1.2%)	20 (0.9%)	- -
Thai	2 (0.1%)	3 (0.2%)	2 (0.2%)	1 (0.04%)	2 (0.09%)
Chinese	38 (2.1%)	55 (4%)	25 (2.4%)	90 (4.1%)	-
European	- -	- -	- -	- -	3 (0.14%)

Items \ Bans	Sisavath Tay	Sisavath Kang	Sisavath Neua	Dong Mieng	Thong Sang Nang
Cambodian	-	1 (0.07%)	-	-	-
Indian	-	3 (0.2%)	7 (0.6%)	-	-
4. Religion					
Buddhism	99%	98%	100%	98%	98.5%
Catholic, Bahaism & Muslim	1%	2%	0%	2%	1.5%
5. Road Condition					
Total Length	3,015m	2,671m	1,451m	2,830m	4,895m
Length and % of Road width 4 m	3,015m 100%	2,671m 100%	1,451m 100%	2,560m 90.4%	4,645m 94.8%
Length and % of Paved road	2,575m 85%	2,451m 91.7%	1,031m 71%	980m 34.7%	1,600m 32.7%
6. Kind and % of drain					
Soil	362m 100%	634m 100%	144m 100%	1,125m 100%	3,664m 100%
Concrete	0	0	0	0	0
7. Percentage of water supply	98.8%	99.6%	98.2%	76.7%	100%
8. Electricity	100%	100%	100%	100%	100%
9. Contract with Private Contractor	86 Residents 24%	11 3.9%	12 6.8%	4 (1.0%)	0 (0.0%)

iii. discharge time

Collection service recipients are responsible for placing their dust bins at the designated places and during the fixed days and times of the collection schedule.

d. Collection method

i. collection system

Bell and curb collection systems are adopted in this experiment. Where bell collection system is used, a collection worker signals to the residents the arrival of the collection vehicle at the fixed collection point through a loudspeaker. Residents around the collection point then bring out their baskets and empty them on the vehicles.

Where curb collection is applied, the residents are responsible for placing the baskets to be emptied at the main road on the collection day and for returning the empty baskets in their storage location until the next collection.

ii. collection point

Collection point is decided according to the terms of the contract for collection.

iii. collection schedule

Collection schedule is established according to the terms of the contract for collection.

iv. collection frequency

In principle, collection frequency is once a week in order to unify the collection fee.

v. collection fee

The collection fee is decided based on the present fee of DCTC and private companies. The residents pay about 500~5,000 kips for collection fees, and the majority pay 1,000 kips. Consequently, the collection fee is 1,000 kips a month per bamboo basket of medium size (about 70 ~ 80 liters).

e. Contract system

The fee collectors are not only involved in fee collection but are also responsible for making contract negotiations with residents and shops for collection services. The list of contract service recipients, contract period and receipt of collection fees are placed in the computer. Contract Sheet, Receipt for Collection Fee and Ledger for Management of Collection Fee were prepared and are shown in Fig. L.2-9, L.2-10 and Table L.2-3, respectively in Appendix L, Supporting Report (3).

In addition, contracted bamboo baskets are marked with green color to distinguish them from not contracted ones.

f. Accounting system

Cash received from fee collectors and operator of disposal sites are checked, the receipts filed and the details noted down in the accounting sheet, which is independent from that of DCTC, within the same day. For this purpose, the accounting sheet was prepared and shown in Table L.2-4 in Appendix L, Supporting Report (3).

The balance in the accounting sheet and cash in the cash box is checked everynight, and the difference is noted down in the accounting sheet.



The collection and tipping fees are deposited in a bank, therefore, an account was opened under the project manager's name.

Money is withdrawn from the bank by the project manager if there is only less than 50,000 kips left in the cash box. If there is more than 100,000 kips, a deposit is made in the bank. At the end of the month, the total of the revenue and expenditure and their sub-totals are summed up.

g. Executing committee for collection experiment

The most important objective in this experiment is the expansion of collection areas. Therefore, this experiment is not limited to temporarily execution, but is to be executed continually with necessary modification.

Because of the above-mentioned reason, it is necessary to initiate the expansion of collection area through the experiment. Executing committee for collection experiment has been established in the DCTC in Vientiane Municipality and it consists of 3 units.

The organization chart is shown in Fig. 10.2.3. The duties of each unit are as follows:

i. administration unit

- general affairs
- personnel management
- accounting
- research and development
- campaign and enforcement

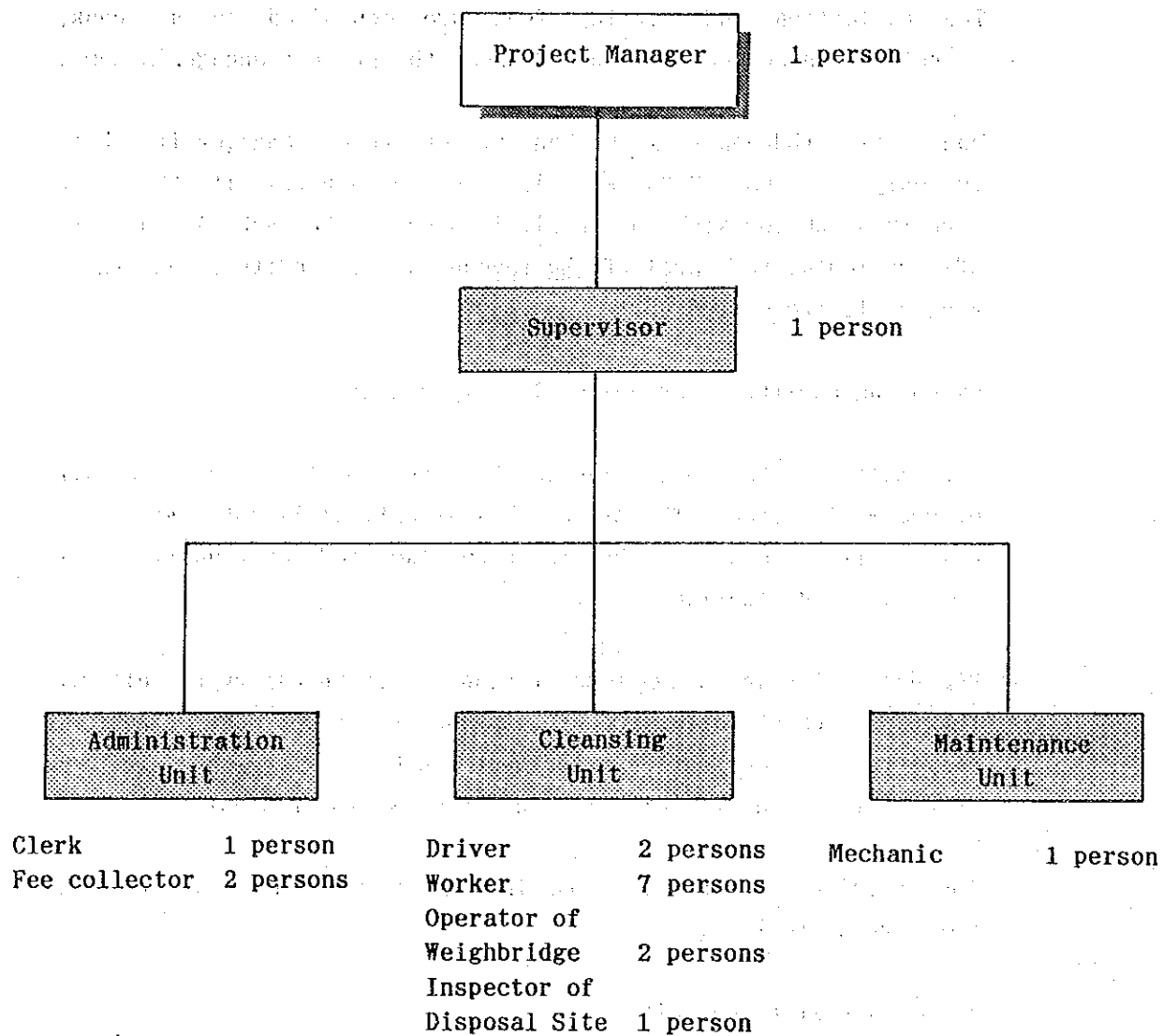


Fig. 10.2-3 Organization Chart of Executing Committee for Collection Experiment

ii. cleansing unit

- refuse collection
- cleansing works
- operation of weighbridge
- management of disposal site

iii. maintenance unit

- maintenance of the collection vehicle

10.2.3 Execution

1) Preparation Work

a. Preparation schedule for the experiment

The following preparation works were executed prior to the commencement of the experiment from February 3 to 23, 1992.

- explanation of purpose and detailed plan of collection experiment to Ban (village) and Nouai (the smallest unit of community in a village) chiefs;
- inducement of residents and shops through the Nouai chiefs to participate in the collection experiment.
- explanation to residents and solicitation of volunteers by chiefs of 5 Bans and Nouais.
- explanation meetings with residents in the 5 Bans concerning the limited number of participants in the experiment by the Study Team, DCTC and chiefs of the 5 Bans.
- final selection of the 3 Bans (Dong Mieng, Sisavath Tay and Sisavath Kang)

- detailed design of the experiment (collection routes, schedule etc.)
- training of fee collectors
- contract, collection of fee, marking of bamboo baskets, etc.
- training of collection crew
- opening ceremony of collection experiment at Sisavath Tay

b. Final selection of experimental areas

As described in the previous chapter, the objective of the collection experiment is to examine the workability of the proposed collection plan in the Basic Plan. In addition, due to the very limited financial capability of the Municipality and the difficulty of obtaining public cooperation, a stepwise approach is proposed to achieve the targets of the Basic Plan. In view of these basic policies of the Study and the limited experimental period (only one month), the Study Team set up the following criteria on final selection of the experimental areas;

- i. Upon consideration of the following 1. extension of collection service, 2. establishment of the Beneficiary-Pay-Principle, 3. establishment of an efficient and reliable collection system and 4. establishment of public cooperation, the experiment should be taken over by DCTC. As such the experiment should achieve some favourable results.
- ii. In terms of the favourable results, the experiment should prove that at least the operation and maintenance cost (personnel expenditure, fuel and lubricant cost, etc.) of the experiment should be covered by the fee collected from the experimental areas. In addition, the experiment should be successfully done in order to extend the collection services in these areas.

iii. Consequently, the ratio of participation in the experiment (percentage of contract service recipients among Ban residents) should be more than 25% and an efficient collection work should be done in the areas.

iv. Afterwards, new strategies and tactics should be formulated to proceed with the expansion of the collection services in other areas.

Based on the above-mentioned criteria, Ban Dong Mieng, Ban Sisavath Kang and Tay were selected as experimental areas. Ban Sisavath Neua and Ban Tong Sang Nang were excluded due to low participation ratio. Ban Tong Sang Nang was also excluded due to its impassable roads.

Number of families wishing to enter into a contract and the participation ratio are shown in Table 10.2-2.

Table 10.2-2 Number of Families Wishing to enter into a Contract and the Participation Ratio

Name of Ban	No. of Families	Contract Families	Ratio (%)	Final Selection
Dong Mieng	382	133	35	Yes
Thong Sang Nang	333	59	17.7	No
Sisavath Kang	276	75	27	Yes
Sisavath Tay	358	98	27	Yes
Sisavath Neua	174	19	10.9	No

c. Detailed design

Detailed design was done according to the terms of the contract for collection services and the location of families who were willing to enter into a contract.

i. basic data for planning

The following basic data were prepared to plan the collection schedule, collection routes and collection points.

Table 10.2-3 Basic Data for the Collection Experiment Plan

Name of Ban	Waste Amount (ton/week)	Waste Volume (m <sup>3</sup> /week)	No. of Trips Required
Dong Mieng	3.4	19.6	2.0
Sisavath Kang	1.9	11.0	1.1
Sisavath Tay	2.5	14.5	1.5

Note:

- \* Waste Amount :  $626 \times 5.9 \times (\text{Contracted Families}) \times 7$
- \*\* Waste Volume :  $(\text{Waste Amount})/0.173$
- \* No. of Trips :  $(\text{Waste Volume})/10$
- \*\* 626 : Amount of Discharged Waste (g/person/day)
- \*\* 5.9 : Average Family Members in Vientiane Urban Area (persons/family)
- \*\* 7 : Days/Week
- \*\* 0.173 : Apparent Specific Gravity (ton/m<sup>3</sup>)
- \*\* 10 : Loading Capacity of the Collection Vehicle Used in the Experiment (m<sup>3</sup>)



## ii. collection schedule

As an experiment, the collection vehicle was operated from Monday to Wednesday mornings. It was used as a stand by vehicle in other days of the week.

Schedule of cleaning-up roads, drains and public areas was formulated by the residents themselves. Collection and haulage of the waste cleaned up was carried out by the Project Team in accordance with the schedule.

## iii. collection routes and points

Collection routes and bell collection points were drawn according to the basic data and collection schedule. The location map of contract service recipients, collection routes and points, and collection routes for cleaning-up of roads, drains and public areas of Ban Dong Mieng are shown in Fig 10.2-4, 10.2-5 and 10.2-6, respectively. Figures of Ban Sisavath Tay and Ban Sisavath Kang are shown in Appendix L, the Supporting Report (3).

## (2) Implementation

The collection experiment was implemented in the three experimental areas from February 24 to March 18, 1992. During the experiment the following studies were carried out in order to examine the workability of proposed plan:

- time and motion study (collection time, the distance for the transport of waste, collection amount of waste, etc.);
- community consciousness survey (comparison of the CCS before and after the experiment);
- examination of operation and management system of collection vehicles;
- examination of the administrative system of workers; and
- examination of the accounting system.

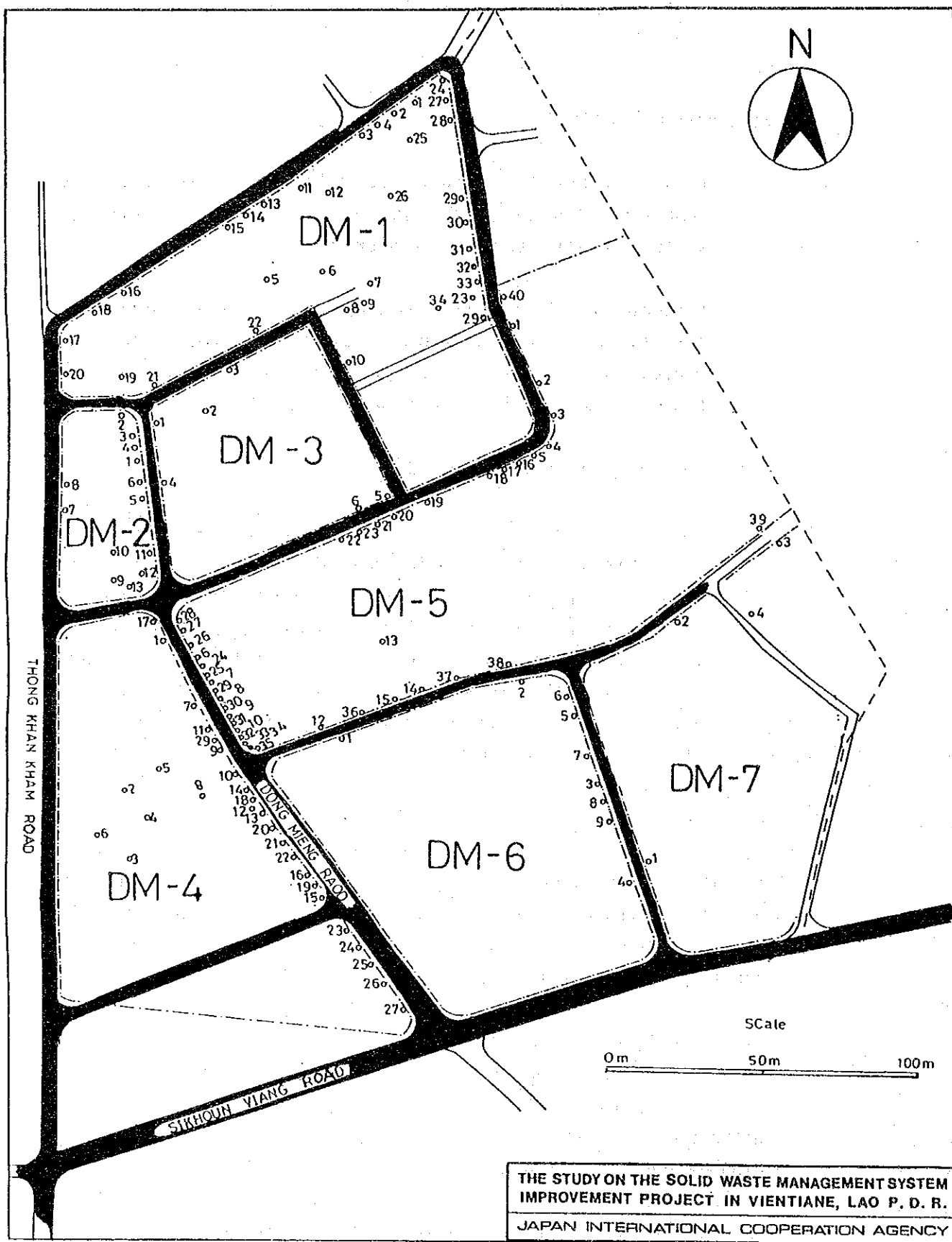


Fig. 10.2-4 Location Map of Contract Service Recipients

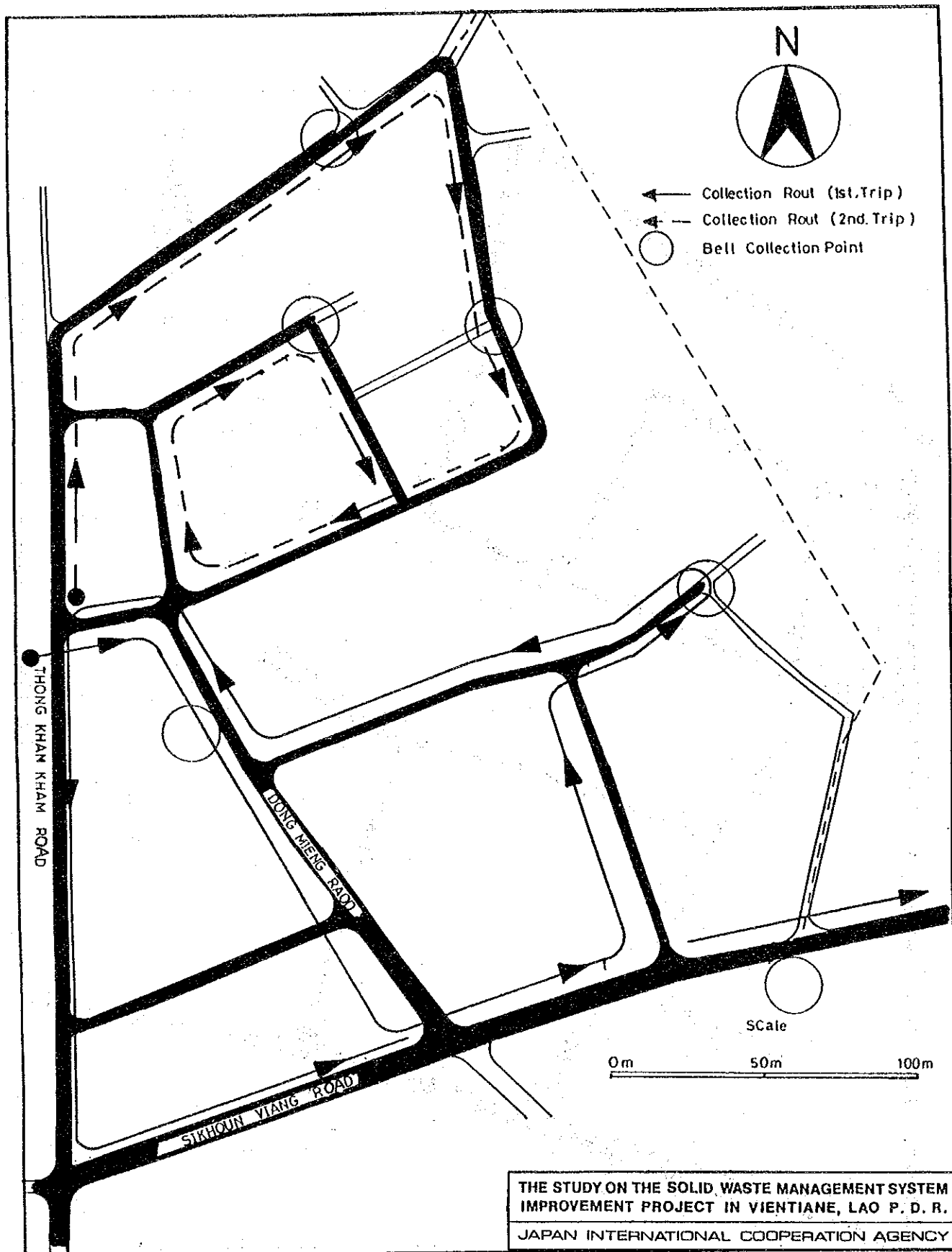


Fig.10.2-5 Collection Routes and Points of Ban Dong Mieng

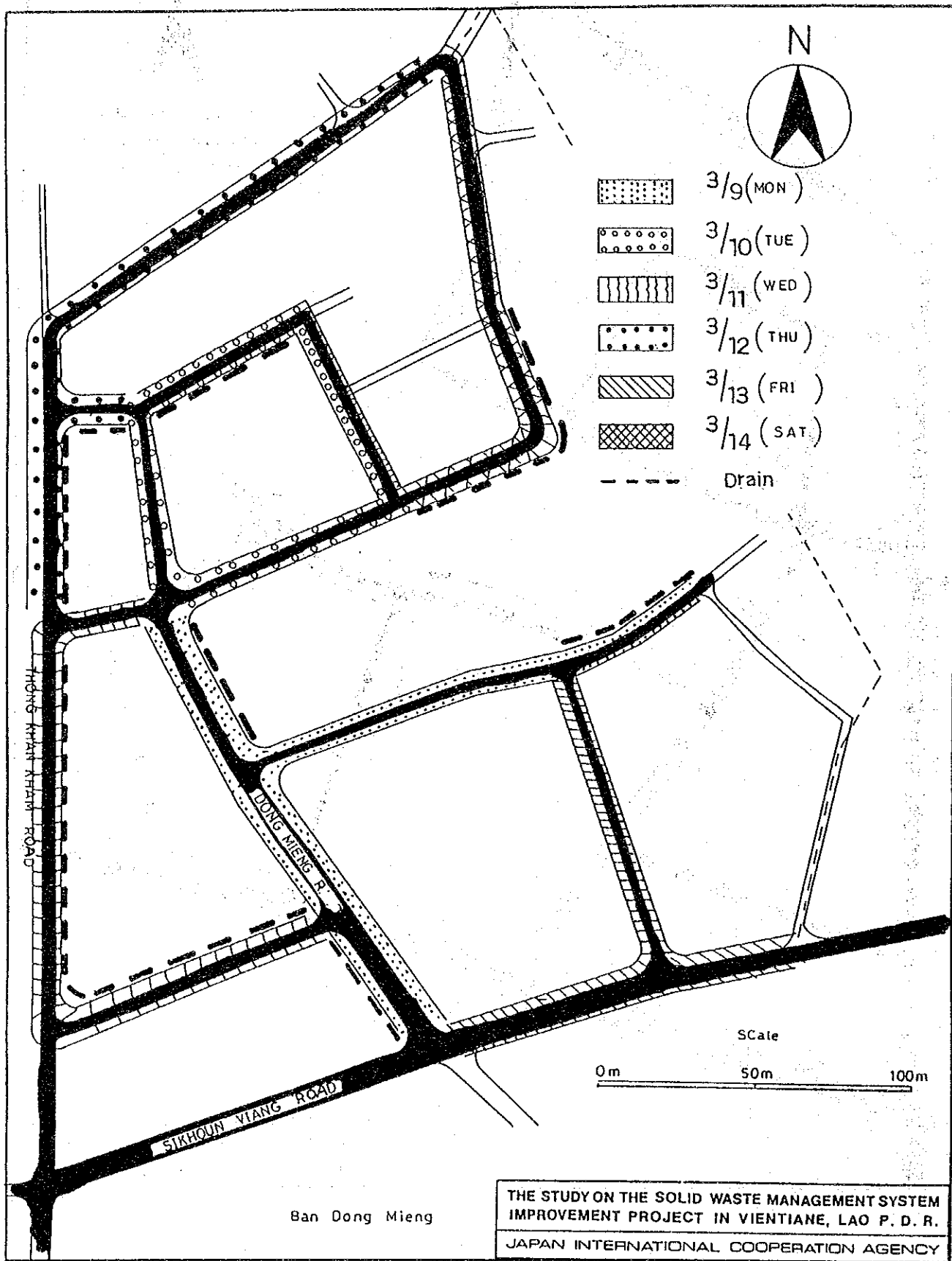


Fig. 10.2-6 Collection Routes for Cleaning-up of Road, Drain and Public Areas in Ban Dong Mieng

Among these, the operation and management of the collection vehicles, administration of workers and the accounting system were executed as immediate improvement measures in the experiment. The contents and results are mentioned in Appendix K.

a. Time and motion study for collection experiment

A time and motion study of the collection vehicle in the experiment was conducted in the following order:

- to examine the proposed collection system in the Basic Plan; and
- to compare the collection efficiency between present collection system and collection experiment.

In order to observe the present collection and haulage system, the time and motion study was executed for 8 days. Each of the collection vehicles of the DCTC and private contractors were traced for 4 days. On the other hand, the vehicle supplied by JICA was traced for 5 days to observe the collection and haulage system of the collection experiment.

The results of the study are described below.

i. time for collection service works

Working time starts from the departure of the collection vehicle from the depot until it arrives in the depot and is shown in Fig. 10.2-7. The length and pattern of the time for collection service works in the collection experiment are very different from those of the present collection system.

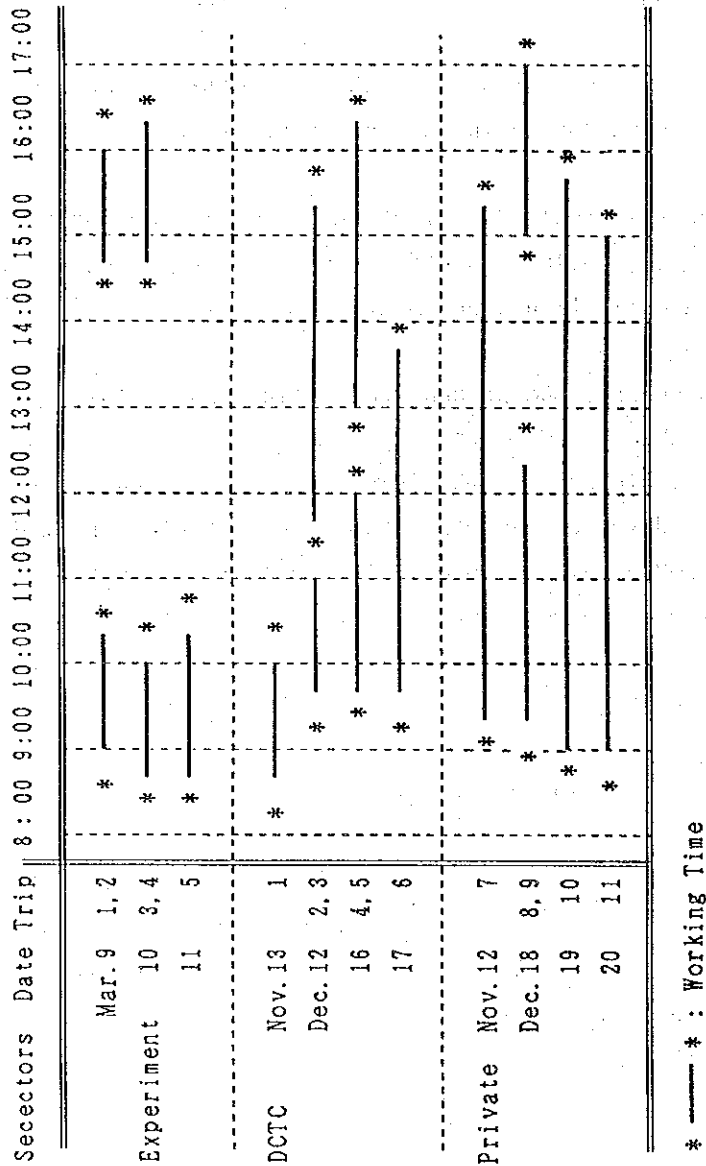


Fig.10.2-7 Time for Collection Service Works

The average working time in the collection experiment is approximately 2 hours per trip. Departure and arrival time of the vehicle is almost regular, however, working time in the present collection system varies from a minimum of 2 hours per trip and a maximum of about 7 and a half hours per trip due to the irregularities in the departure and arrival time of the vehicles.

Working time covers the following:

- collection time;
- commuting time between stations;
- commuting time aside from that between stations;
- unloading time; and
- others (lunch, rest, repair etc.).

The items of the working time are stated in Fig. 10.2-8. The difference in the working time of the collection experiment and the present system can be mainly attributed to the collection time. Collection time of the experiment is about 30 minutes per trip, while collection time of present system is as shown below.

Average	:	120 minutes
Minimum	:	40 minutes
Maximum	:	250 minutes

ii. distance

The distances covered by the collection services are as follows:

- distance from the depot to the collection area;
- distance in the collection area;
- distance from the collection area to disposal site; and
- distance from disposal site to the depot or next collection area.

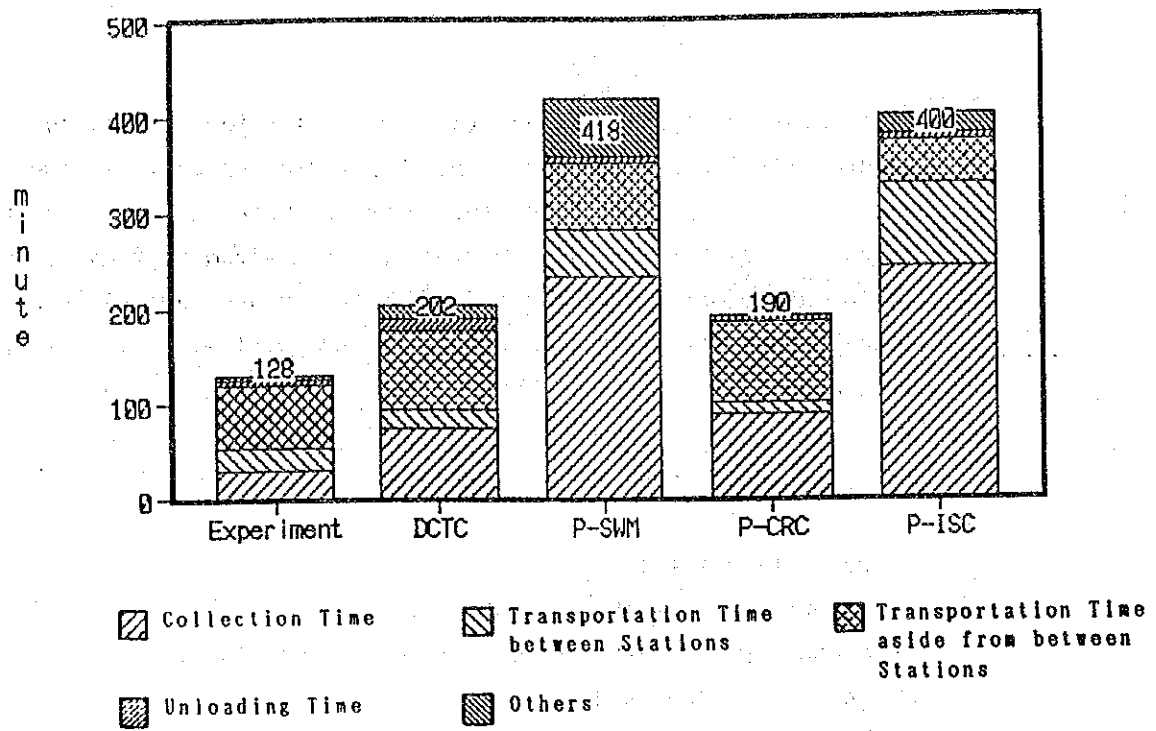


Fig.10.2-8 Comparison of Working Time for One Trip

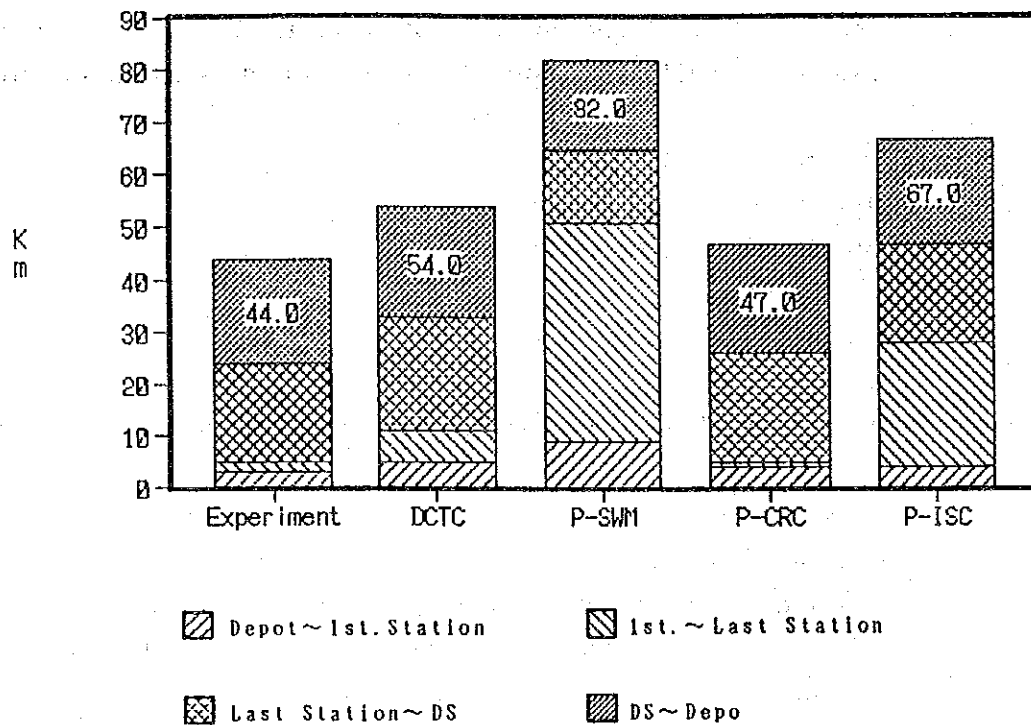


Fig.10.2-9 Comparison of Transportation Distance for One Trip



The distances covered by the collection services are shown in Fig. 10.2-9. The commuting distance in the present system is larger compared with that of the experiment. Moreover, the distance in the collection area of private-SWM and private-ISC is exceptionally long.

iii. amount of collected waste

Average amount of collected waste of each sector is observed as follows:

Experiment	:	1.2 ton/trip;
DCTC	:	1.7 ton/trip; and
Private Contractors	:	2.4 ton/trip.

On the other hand, loading ratio is calculated as shown below. Hereupon, loading ratio means the ratio of loading volume of waste per trip to the loading capacity of the vehicle.

Loading ratio of vehicle for experiment : 70 %

Loading ratio of DCTC vehicles : 110 %

Loading ratio of vehicles belonging to private contractors: 130 %

Note;

$$- [\text{Loading Ratio (\%)}] = [\text{Loading Volume of Waste per Trip}] / [\text{Loading Capacity of Vehicle}] \times 100 \%$$

$$- [\text{Loading Volume of Waste per Trip}] = [\text{Loading Amount of Waste per Trip}] / 0.173*$$

\* 0.173 = Apparent Specific Gravity (ASG) observed by the WACS for waste hauled in KM18-DS

Amount of waste loaded by collection vehicles of DCTC and private contractors exceeds that of the collection experiment. The loading ratio, however, already exceeds 100% of the loading capacity of the vehicle. It is, therefore, concluded that the capacity of the vehicle for collection experiment will be able to response to the increase of waste up to 100% by the expansion of the collection areas and that over loading may result in frequent breakdowns of collection vehicles and irregular collection services.

- iv. Collection efficiency of experiment and present system are shown in Table 10.2-4. The Collection amount per working time per worker in the experiment was not so different from that of the other sectors at 113 kg/hr/worker. This is due to the fact that the collection vehicle in the experiment maintains the loading capacity while the present system exceeds it. The collection amount per collection time per worker, however, is considered to be considerably effective compared to other sectors at approximately 480 kg/hr./worker.

The following are concluded from the above mentioned comparison between present collection and collection experiment.

- The collection routes established in the collection experiment are proven to be suitable.
- The curb and bell collection systems proposed in the Basic Plan are accepted with the cooperation of the residents and collection was conducted in accordance with the collection time.

b. Community consciousness survey for collection experiment

A CCS (Community Consciousness Survey) was conducted in order

- to confirm the change in the awareness of the community before and during the collection experiment; and

Table 10.2-4 Comparison of Collection Efficiency

Items	Experiment	DCTC	P-SWM	P-CRC	P-ISC	Remarks
1. Basic Information						
a. Average Number of Crews	5	5	5	5	7	
b. Total Number of Trips Studied	5	6	2	2	1	
c. Average Capacity for Loading(m3)	10	9	12	10	10	
2. Average Time for One Trip(min.)						
d. Collection Time	30	74	232	88	243	
e. Transportation Time						
f. Between Station	24	21	50	13	86	
g. Other Transportation	66	83	71	84	45	
h. Unloading Time	5	12	5	5	5	
i. Others(lunch, rest, repair etc.)	3	12	60	0	21	
j. Total	128	202	418	190	400	
3. Average Distance for One Trip (Km)						
k. From Depot to 1st. Station	3.0	5.0	9.0	4.0	4.0	
l. From 1st. Station to Last Station	2.0	6.0	42.0	1.0	24.0	
m. From Last Station To Dump Site	19.0	22.0	14.0	21.0	19.0	
n. From Dump Site to Depot or Next Collection Area	20.0	21.0	17.0	21.0	20.0	
o. Total	44.0	54.0	82.0	47.0	67.0	
4. Average of Loading Waste for One Trip(Kg)	1,210	1,700	2,430	2,200	2,570	
5. Collection Efficiency						
Collection Amount per Working Time per Worker(kg/hour/worker)	113	101	70	139	55	4./((j/60) *a)
Collection Amount per Collection Time per worker (kg/hour/worker)	484	276	126	300	91	4./((d/60) *a)
6. Loading Ratio(%)	70	109	117	127	149	4./ (c* 0.173)*100

0.173 : Apparent Specific Gravity (ASG) observed by the WACS for waste hauled in KM18-DS

- to check the adaptability of the proposed collection system in the collection experiment.

The survey was conducted to compare the degree of awareness of the community before (February 20) and during (March 12) the execution of the collection experiment.

The households covered by the CCS were selected from the candidate areas of the collection experiment. Although Bans Sisavath Neua and Tong Sang Nang were excluded from the collection experiment, they were included in the CCS in order to know the possible expansion method for their area. The survey areas and number of samples are as follows:

	Survey Areas	Number of Samples
Before the execution of collection experiment		15
	Sisavath Tay	5
	Sisavath Kang	5
	Dong Mieng	5
During the collection experiment		19
	Sisavath Tay	5
	Sisavath Kang	5
	Dong Mieng	5
	Sisavath Neua	2
	Tong Sang Nang	2

Note: The same households were selected from Sisavath Tay, Kang and Dong Mieng both before and during the collection experiment.

A questionnaire was prepared based on the CCS questionnaire which was used to grasp the present condition of SWM in the study area.

The results of the survey are summarized as follows:

i. general conditions

- Residents who have been receiving collection services from private contractors before the collection experiment.....

2 residents (13%)

- Residents who received collection services through the collection experiment.....13 residents (87%)

Total expenditure per month per family is more than 50,000 kips. One third of the residents in the experimental areas and three fourths in the non experimental areas exceeded 100,000 kips per month.

ii. discharge and storage

- discharge points

Waste was discharged in various places before the experiment. However, discharge points were changed to collection points with the use of bamboo baskets in the experiment. In the non-experimental areas, discharge points of waste are mainly places recognized by the community.

- dustbins

The majority of the residents have been using bamboo baskets to store and discharge waste before the experiment. Therefore, the use of bamboo baskets as dustbins is acknowledged in the experiment.

- discharged volume of waste

The discharged volume of waste increased to around 50 liters to 70 liters in the experiment.

- discharge time of waste

50% of the residents discharged waste in the morning and the other 50% in the evening before the experiment. In the experiment, discharge time of waste was divided into three: before 9 o'clock, 9 - 12 o'clock and 12 - 15 o'clock. It is also believed that the residents discharge their waste in accordance with the collection time.

- garden waste

Discharge method of garden waste has been changed. Before the experiment, 70% of the residents burned them in the open places, however, during the experiment, 90% of the residents discharge it along with the other wastes generated from residences.

- Most of the residents sometimes sweep the roads and public areas and clean the drains. No change has been observed concerning the frequency before and during the experiment.

### iii. collection service

- All of the residents receiving collection services indicate satisfaction.
- All of the residents received collection services at a fixed day and time in the experiment.
- 14 residents (93%) pay 1,000 kips per month and 1 resident (7%) pays 2,000 kips per month for collection fees.

- The residents' reason for receiving collection services before the experiment was due to the absence of a disposal site. During the experiment, however, community consciousness was heightened according to the following reasons given by the residents when asked of the same question.

- . because it cleans the premises...6 residents (40%)
- . because it cleans the area...3 residents (20%)
- . because it improves sanitary conditions...3 residents(20%)

iv. community consciousness on waste

- Percentage of residents who received guidance on the proper discharge of waste during the experiment has increased compared with before the experiment. This can be mainly attributed to the meetings conducted for explaining matters concerning the experiment.
- The percentage of residents who are aware of the "Clean Day" in their area and participate in the activity increased due to the execution of cleaning of roads, drains and public areas through public cooperation in the collection experiment.
- Percentage of residents who consider their area to be beautiful has increased from 33% before the experiment, to 87% during the experiment.
- The percentage of residents who think that collection services are necessary to clean up the area increased from 40% before the experiment, to 100% during the experiment.

Details of the results of the CCS are described in Appendix L, the Supporting Report (3).

#### 10.2.4 Continuation by DCTC

The collection experiment was taken over by DCTC from the middle of March 1992. The following aspects are found out through the collection experiment taken over by DCTC.

##### 1) Number of Families and Shops Contracted

Number of families and shops contracted with DCTC is kept almost the same number as when experiment was commenced, as shown in Table 10.2-5. Although fee collectors made an effort not to reduce the number of collection service recipients, some of collection fee was not able to be collected from the recipients due to the absence of masters and owner. Therefore, it is necessary to examine the time and schedule of fee collection. Moreover, DCTC shall delete the contract marks on the baskets of the household who canceled waste collection service contract in order to keep the Beneficiary-Pay-Principle and avoid the delivery of a collection service without collection fee.

Table 10.2-5 Number of Families and Shops Contracted

	March	April	May	June
Ban Dong Mieng	133	134	135	133
Ban Sisavath Tay	101	107	95	99
Ban Sisavath Kang	87	90	83	77
Total	326	331	313	309



## 2) Balance of Revenue and Expenditure on Collection Experiment

The balance of revenue and expenditure on collection experiment is shown in Table 10.2-6. During experiment, an accounting system was established apart from the other DCTC accounting. The expenditure concerned with the experiment, e.g. personnel expenditure, fuel & lubricant for collection vehicle and operation & maintenance expenditure, was released by the fee collected from residents and tipping fee collected from the incoming vehicles to KM 18-DS. The results of the balance for four months are shown as follows.

Revenue : 1,615,910 kips  
 Expenditure : 1,111,390 kips  
 Balance : + 540,520 kips

Table 10.2-6 Balance of Revenue and Expenditure

Unit: kips

	Revenue	Expenditure	Balance
March	402,110	353,490	+ 48,620
April	455,400	155,630	+ 299,770
May	405,400	291,100	+ 114,300
June	389,000	311,170	+ 77,830
Total	1,651,910	1,111,390	+ 540,520

### 3) Amount of Waste Hauled to KM 18-DS

Amount of waste hauled to KM 18-DS from the commencement of observation by the truckscale (November 11, 1991) to the commencement of collection experiment (January 23, 1992) is shown as follows;

DCTC	: 6.1 ton/day (35%)
Private Contractors	: 7.8 ton/day (45%)
Directly	: 3.5 ton/day (20%)
<hr/>	
Total	: 17.4 ton/day (100%)

Amount of waste hauled to KM 18-DS from February to May was changed as follows;

DCTC	: 7.7 ton/day (37%)
Private Contractors	: 8.4 ton/day (40%)
Directly	: 4.7 ton/day (23%)
<hr/>	
Total	: 20.8 ton/day (100%)

The waste collection capability of DCTC increased by 1.6 ton/day in comparison with before the experiment. 1.6 ton/day is equivalent to 26% of the present waste collection capability of DCTC. It was deduced that the capability of DCTC was improved the collection capability of DCTC and private contractors became almost equal.

#### 10.2.5 Findings

##### a. Ratio of participation

Number of residences and shops contracted in the experiment were 306. The figure is equivalent to 30% of the total number of families in the 3 bans, while the present ratio of residences covered by the collection service in Vientiane urban area is only 4.8% in the residential area.

##### b. Revenue and expenditure of the experiment in February - March

As shown in Table 10.2-7, total amount of fee collected during the one-month experiment was 314 thousand kips. This is equivalent to about 50% of the total waste collection fee per month of DCTC in 1990.

Table 10.2-7 Revenue and Expenditure of Collection Experiment

Unit; Kips

Item	Revenue Expenditures
1. Revenue	<u>402,110</u>
- Collection Fee	314,000
- Tipping Fee	88,010
- Others	100
2. Expenditure	<u>353,490</u>
- * Personnel Expenditure (18 persons)	216,300
Administration (5 persons)	(38,200)
Cleansing Service (10 persons)	(138,100)
KM 18-DS (3 persons)	(40,000)
- Fuel & Lubricant for Vehicle	100,200
- Maintenance for Vehicle	28,000
- Others (Administrative Expenditure etc.)	8,990
3. Balance	<u>48,620</u>
- Total Revenue	402,110
- Total Expenditure	353,490

\* Note; The figure 216,300 includes the personnel expenditure for actual working days in the experiment; i.e., two and half days per week.

The balance of revenue and expenditure had a surplus of about 49 thousand, therefore, proving the feasibility of the experiment.

c. Bell and curb collection system

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.

d. Collection service

Some of the residents and shops in the area requested for the collection of other waste not stipulated in the contract. By continuous explanation and instructions, however, only contracted wastes were strictly collected. Finally, the residents understood the principle.

e. Extra fee

In order to respond to the request for the discharge of extra amount of waste, the charging of extra tickets (250 kips/basket) was proposed to residents and shops who temporarily discharged large amount of waste.

f. Cleaning-up of public area

As for the cleaning-up of roads, drains and public areas through public cooperation, a cleansing day was proposed and implemented in each Ban.

The Study Team informed the chiefs of the 3 Bans the designated day for cleaning, method of cleaning and type of waste to be cleaned, and asked them to explain the details to the residents and to solicit volunteers. In addition, announcements were made on the loudspeaker before the designated days. The result of the cleansing work by the residents, however, was not satisfactory.

DCTC as well as the chiefs of the Bans were requested to take further efforts such as the implementation of public campaigns and education, in order to achieve public cooperation in its cleansing services.

g. Role of fee collectors

The role of the fee collectors is considered to be quite important. Their two major duties are to conduct contract negotiations and to collect fees and to act as the medium of the DCTC administrators and the residents in order to improve SWM in the area. These duties are important factors in the extension of collection services.

h. Results of the experiment taken over by DCTC

The number of contracted households was kept constantly at about 310 to 330. The proposed accounting system, operational system for the weighbridge and organization set up for the experiment have been well maintained in these four months. (from March to June 1992)

During the four months operation of collection experiment, the proposed fee collection system has been carried out successfully. Then the surplus of the experiment, which was drawn up from the total revenue and expenditure including maintenance cost, summed up to 540,520 kips. This proved that DCTC would be able to replace the vehicle after 7 years according to the following calculation:

$540,520 \times *2 \times **3 \times 7 \text{ years} = 22,701,840 \text{ kips}$

Note:

\*2 ; Working days per week can be 5 days instead of 2.5 days

\*\*3 ; 12 months/4months = 3

The price of vehicle procured and supplied by JICA for the experiment was 22 million kips including 10% of spare parts and transportation cost.

In order to keep the Beneficiary-Pay-Principle and to avoid the delivery of a collection service without collection fee, DCTC shall delete the contract marks on the baskets of the household who canceled waste collection service contract.

- i. Examination of the reduction of the proposed collection fee (1000 kips/household/month)

By the year 1995, the proposed collection fee system shall be maintained and collection service ratio will be increased from 4.8% upto 50%. This target could be achieved by the expansion method proposed by the Study. It seems, however, to be very difficult to increase the ratio from 50% to 100% by 2000 due to the existence of the poor households. It shall be, therefore, necessary to reduce the proposed collection fee making up the deficit by means of the cross-subsidy through the introduction of a new tax system for the Municipality or the increase of the present land tax.

### 10.3 Experiment on Sanitary Landfill Operation

#### 1) Objectives of the Experiment

Basically, the objectives of the experiment on sanitary landfill operation were:

- i. to demonstrate the impact of environmental improvement at the present KM 18-DS by the execution of sanitary landfill operation;
- ii. to examine the workability of the level 2 sanitary landfill development and operation proposed for one of the first priority project of the Basic Plan; and
- iii. to identify the problems and obstacles to be solved for the successful execution of the sanitary landfill development and operation at level 2.

However, in order to obtain the first objective, that is to demonstrate the impact of the environmental improvement, it was necessary to execute the following immediate improvement measures:

- i. to clean-up scattered waste and those disposed at the entrance, etc.;
- ii. to prepare good access roads within the KM 18-DS; and
- iii. to fence the front of the site.

The above-mentioned measures have been executed at the time of the experiment on sanitary landfill operation.



## 2) Proposed Plan

### a. Site development plan

First of all, the development of the KM 18-DS had to be done prior to the commencement of the experiment on sanitary landfill operation. The site development plan is illustrated in Fig. 10.3-1, and the outline of it is described below.

#### i. clean-up site

Since a crude open dumping has been conducted for more than 20 years at the KM 18-DS, a considerable amount of wastes were disposed disorderly. These wastes, especially those disposed at the entrance not only uglify the areas but also impede landfill operations. It is, therefore, necessary to primarily clean up the wastes disposed at the entrance and proposed experimental area of the KM 18-DS.

#### ii. construction of an enclosing bund

After the clean-up, an enclosing bund for the experiment, as shown below, was constructed in accordance with the following:

- construction of the embankment with the cleaned up wastes;
- excavation of the bottom of the experimental area to obtain cover soil; and
- covering the embankment with the soil excavated.

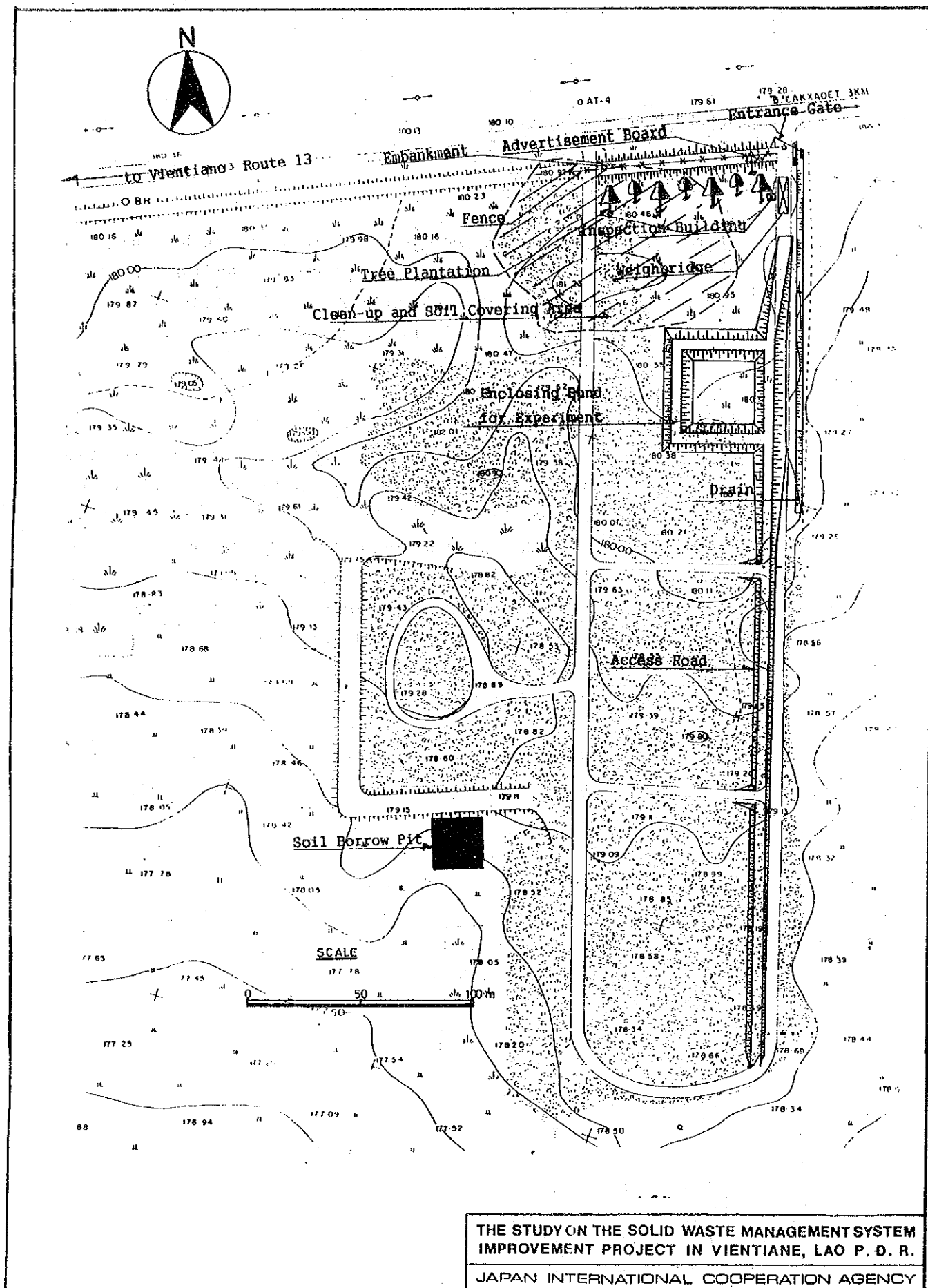
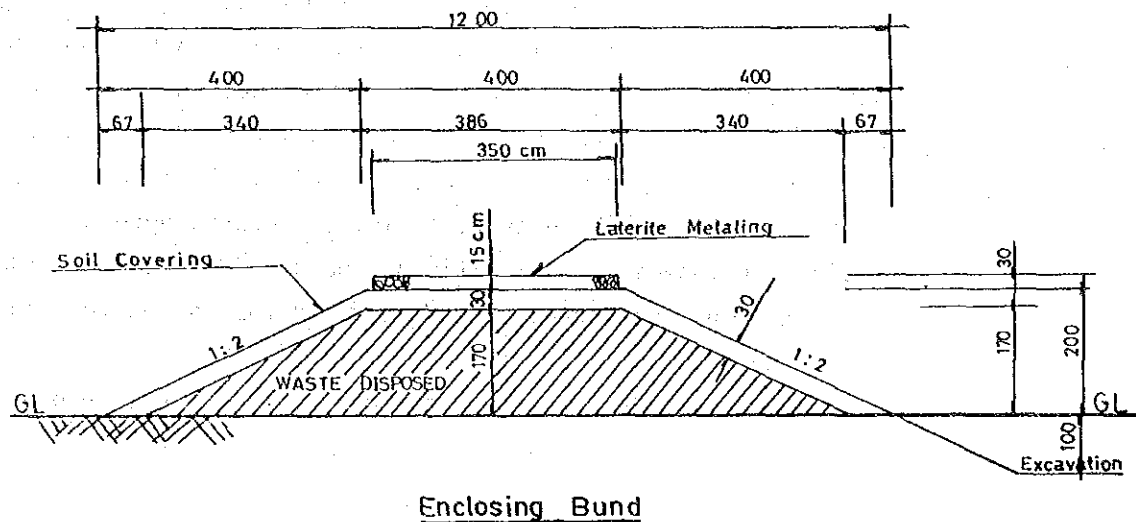


Fig.10.3-1 Site Development Plan for the Experiment on Sanitary Landfill



### iii. construction of good access roads

Since there were no landfill equipment available at the KM 18-DS and it was very difficult to obtain one, changes in the landfill operation after the experiment were not supposed to occur and many difficulties, especially in terms of access to the inside of the site, were expected.

The construction of a good access road within KM 18-DS was proposed in order to avoid dumping waste at the entrance. The access road is constructed with the soil obtained from the site borrow pit.

#### iv. Improvement of the entrance

Due to more than 20 years of crude open dumping, the residents of Vientiane Municipality do not carry a good image of the KM 18-DS. To them the site is a kind of dirty latrine, many flies, leachate, odor, waste littering, and even fire can be found. Since route 13 is the trunk road of the nation, a lot of the people noticed that the KM 18-DS is one of the dirtiest place in Vientiane. It is, therefore, necessary to revise the images of the citizens on the KM 18-DS in order to secure the continuous use of the site for the Basic Plan.

The improvement plan of the entrance of the site is proposed as follows:

- clean-up disposed waste;
- covering the cleaned up area with soil obtained from the borrow pit;
- construction of a bund along route 13;
- construction of a fence on the bund;
- plantation of coconut trees and tako trees (specie of local tree) on the bund;
- installation of an advertisement board which explains sanitary landfill operation;
- construction of a drain along the access road into the inside of the site; and
- construction of an entrance gate.

#### b. Operational plan

Due to the expenditure for the site development plan, the budget for the sanitary landfill operation was limited. In order to execute a sanitary landfill operation with a limited budget, the following operational plan is proposed:

a. Waste is filled in places directed to the driver by the staff.

b. Dumped waste is spread and crushed by a bulldozer onto a flat horizontal layer for sufficient compaction.

c. After the completion of landfill operations, the covering operation is performed by the sandwich method.

d. Final cover is laid on top of the layer of landfill.

### 3) Results

#### a. Execution

##### i. joint work

In order to pursue technology transfer to the Laotian counterparts, the experiment was carried out with the joint work of DCTC and the Study Team. The DCTC was requested to assign the following staffs to the experiment by the Study Team;

- two operators for a bulldozer and a hydraulic excavator;
- a driver for a dump truck; and
- an engineer for the supervision of the experiment.

However, the request was not realized, except for the assignment of the engineer, because the equipment and vehicles were rented from a private company and the operators of DCTC were not able to operate them.

## ii. execution

The site development works commenced on February 13, 1992 and the sanitary landfill operation started on February 23, 1992. The experiment ended on March 21, 1992. For the execution of sanitary landfill development and operation, the following equipment and vehicles were deployed according to the demand of the works:

- a bulldozer;
- a hydraulic excavator;
- three dump trucks;
- a wheel loader; and
- a motor grader.

## b. Findings

Results and findings following the execution of the experiment on sanitary landfill operation are described below.

- i. After the completion of the basic site development, the experiment on sanitary landfill operation commenced on February 23 in the presence of the governor and vice governor of Vientiane Municipality. It was a great opportunity for the highest municipal administrators to understand the necessity of sanitary landfill operation, because they knew the previous KM18-DS before the development and they were surprised on the big change on the view of the area. Subsequently, the authorization of KM 18-DS and securing land for it was smoothly done. In addition, a special budget for the improvement of the site and securing land was allocated by the Municipality.

- ii. Since the development of the site included a landscaping work, i.e. clean-up and covering the entrance with soil, plantation of trees, and construction of fence and entrance gate, the dirty entrance of the site was made as a playground in which the surrounding residents could enjoy sports. The development tremendously improved the image of the KM 18-DS.
- iii. As a road was constructed from the soil obtained at the borrow pit, smooth access was achieved even in the rainy season. Consequently, the dumping at the entrance stopped and the unloading time of the collection vehicles at the site was reduced.
- iv. It is concluded, therefore, that the sanitary landfill operation of level 2 can be done by DCTC if the necessary equipment were available. The necessity of the sanitary landfill operation was clearly understood by the relevant authorities.

# CHAPTER 11

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## FEASIBILITY STUDY OF THE FIRST PRIORITY PROJECT



## CHAPTER 11      FEASIBILITY STUDY OF THE FIRST PRIORITY PROJECT

### 11.1 Preliminary Design of Technical System

#### 11.1.1 Design Conditions

##### 1) Contents of the First Priority Project

Stepwise approach is necessary to achieve the targets of the Basic Plan due to the financial limitations and difficulty in obtaining public cooperation.

The Phases of the improvement plan are as follows.

- a. Phase I      1995 - 1997
- b. Phase II     1998 - 2000

Prior to the commencement of the Phase I project, immediate improvement projects were proposed to ensure a successful implementation.

The Basic Plan consists of various projects. Among these is the first priority project regarding the technical system in 1995 (Phase I), and the outline is as shown below.

- Extension of collection service area;
- Establishment of appropriate transfer system for institutional wastes;
- Establishment of public cooperation for cleaning-up roads and drains;
- Establishment of proper operation and maintenance system; and
- Construction and execution of a sanitary landfill (level 2) at the KM 18-DS.

## 2) Design Conditions

The following are the design conditions of the first priority project:

- target year ; 1995
- target area ; Vientiane urban area
- population ; 163,100 persons
- collection service coverage in residential area ; 50%  
(4.8% at present)
- service population ; 81,500 persons
- collection amount ; 68.3 ton/day
  - by Vientiane Municipality (58.3)
  - by private contractor (10.0)
- road sweeping service by Vientiane Municipality ; 15 km
- cleansing activity through public cooperation ; 48 Bans  
(villages)
- length of road for sprinkling water ; 150 km
- final disposal amount ; 72.3 ton/day
- final disposal level ; level 2
- waste stream; as shown in Fig. 11.1-1



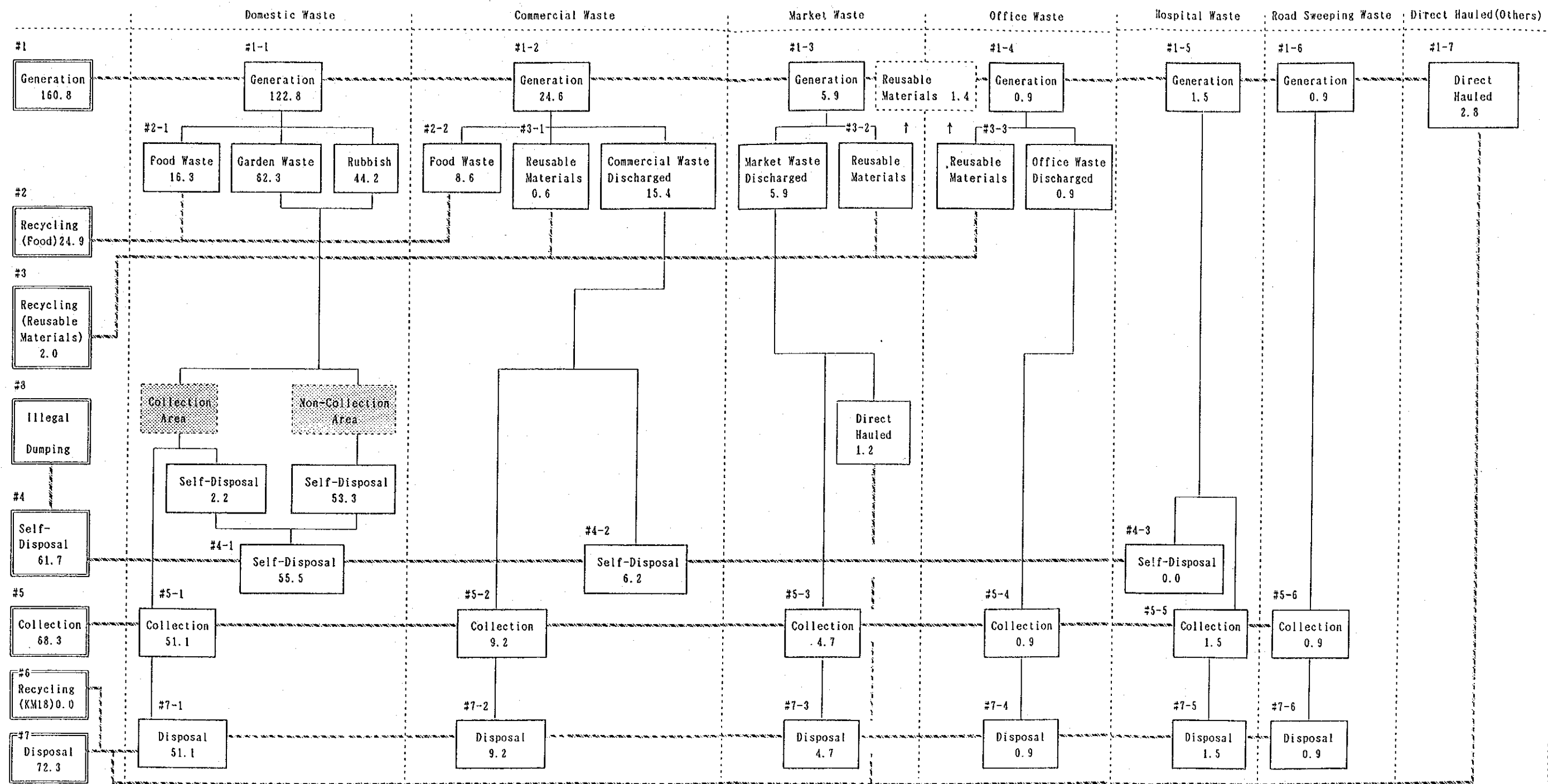


Fig. 11-1-1 Future Waste Stream in The Study Area(1995) (Unit: Ton/Day)



### 11.1.2 Strategy for Expansion of Collection Area

As described in the previous section 11.1.1, the present ratio (4.8%) of residents covered by the collection services shall be increased to 50% in 1995 based on the Beneficiary-Pay-Principle due to the weak financial situation of the Municipality. The implementation, however, will be very difficult. The collection experiment, therefore, was carried out in order to derive a strategy for the expansion of collection area.

#### 1) Collection Experiment

The collection experiment was carried out to mainly examine the following:

- extension method of collection services;
- establishment of the Beneficiary-Pay-Principle;
- establishment of an efficient and reliable collection system; and
- establishment of public cooperation.

In order to examine the above, the Study Team set up the following criteria on final selection of the experimental area:

- i. Upon consideration of the nature of the experiment, the experiment should be taken over by DCTC after it is conducted by the Study Team. As such, the experiment could achieve favorable results to some extent.
- ii. To achieve these favorable results, the experiment should at least prove that the operation and maintenance cost (personnel expenditure, fuel and lubricant cost, etc.) of the experimental areas can be covered by the fee collected from the participant in the experimental area. In addition, the experiment should be successfully conducted in order to extend the collection services in these areas.

iii. Consequently, the ratio of participation in the experiment should be more than 25% and an efficient collection work should be done in the areas.

iv. Afterwards, new strategies and tactics should be formulated to proceed with the expansion of the collection services in other areas.

As a result, the three Bans were selected from 5 candidate Bans. Table 11.1-1 shows the relation of population density and participation ratio in the candidate Bans.

Table 11.1-1 Population Density and Ratio of Participation in the Candidate Bans

Name of Ban	Population Density (person/ha)	Ratio (%) of Participation	Final Selection
Dong Mieng	73	35	Yes
Thong Sang Nang	42	17.7	No
Sisavath Kang	102*	27	Yes
Sisavath Tay	102*	27	Yes
Sisavath Neua	102*	10.9	No

Note: \*Sisavath Kang and Neua were established recently when Sisavath Tay was divided. Only the total area of 3 Bans is available at this moment.

After the experiment was conducted for four months, the following findings were observed:

- 30% of the total number of families in the 3 Bans participated in the experiment, and the number of contracted households was kept constantly at about 310 to 330.