社会開発調査部報告書

No. 22

REPUBLIC OF GUATEMALA
MUNICIPALITY OF GUATEMALA

THE STUDY ON SOLID WASTE MANAGEMENT IN METROPOLITAN AREA OF GUATEMALA CITY

FINAL REPORT

VOLUME III SUPPORTING REPORT

SEPTEMBER 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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1. Collection

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1.1 Collection

1.1.1 Reference data relating to Collection

(1) Waste generation per person a day

During the first and second surveys, solid waste analyses were carried out. The first survey was conducted from July to August 1990 and the second survey was done from January to March 1991.

The aim of these surveys are to study solid waste quantity and quality in Guatemala City and surrounding cities, to find out the fundamental generation quantity and quality of domestic solid waste.

1.1.2 Classified Fundamental Quantity

The fundamental generation quantity by classified sources was found out.

Generation sources of domestic solid waste were classified into four classes: high class, middle class, low class and slum.

In addition to domestic waste, commercial and market waste were also sampled, and their composition were analysed and measured.

Samples were obtained from the following selected model areas:

Table 1-1-1 SOLID WASTE SAMPLING AREAS

CLASS	NAME	ZONE
High 1	Tecun Uman	Z.15
High 2	Aeropuerto	Z.13
Middle 1	Las Victorias	Z. 1
Middle 2	Mirador II	Z.11
Low 1	La Parroquia	Z. 6
Low 2	Roosevelt	Z.11
Slum 1	Lourdes	Z. 5
Slum 2	Trinidad	Z. 1
Commercial	Centro Com. Montufae	Z. 9
Market	Mercado SUR 2	Z. 4
Building	Centro Empresarial	Z.10

Waste was collected from every house, and measured to find out the fundamental generation quantity (kg/cap./day).

The results can be listed as follows:

Table 1-1-2 Domestic Waste Generation (1990,1991)

Unit: Kg/cap./day

Item \ Class		High 1 2	Middle 1 2	Low 1 2	Slum 1 2
1990	Sample No.	60 48	49 44	47 44	51 62
	Average	0.674 0.852	0.468 0.726	0.650 0.539	0.257 0.394
1991	Sample No.	78 61	52 48	52 52	78 66
	Average	0.730 0.812	0.465 0.599	0.516 0.490	0.239 0.293
Total Sample No.		247	193	195	257
Sum Average		0.767	0.564	0.549	0.296

Solid waste was sampled from 4 different classes of families that were high class, middle class low class and slam.

The total number sampled were 892 families, 405 families in 1990, and 487 families in 1991.

The quantity of waste generated is in proportion to the families classified levels of income. High class family generation is biggest of all, it is 0.767 kg/cap./day, and smallest one is slum's 0.296 kg/cap./day.

It is thought that the generation of waste is concerned with the level of income and consumption of living goods.

(2) Solid Waste Composition

After obtaining the fundamental quantity, the solid waste was treated to obtain specific weight and then classified into ten kinds of composition.

1) Volumetric weight (Apparent Specific Weight)

The arranged samples were put into 50 litter bins and let to settle until the contents of the bins were filled by adding more to compress the waste. This process was done three times. And then the calculations were taken under this function.

$$\text{Specific weight (kg/l)} = \frac{\text{Total Weight(kg)-Bin Weight(kg)}}{\text{Bin Volume (litters)}}$$

2) Classification of Waste

All samples were spread and weighed and classified according the following categories:

1. Paper
2. Textile
3. Plastic
4. Rubber, Leather

5. Wood, Coco
6. Garbage
7. Metal
8. Glass
9. Stone
10. Other

$$\text{Classification}(\%) = \frac{\text{Classified items weight (kg)}}{\text{Total weight (kg)}} \times 100$$

The following table shows the results of classified solid waste composition.

Table 1-1-3 Solid Waste Composition (1990,1991)

Unit: %

Item \ Class	High	Middle	Low	Slum	Commercial	Market	Building	Super Market
Apparent Specific Weight(kg/l)	0.212	0.252	0.254	0.248	0.132	0.255	0.066	0.063
Garbage	59.7	62.4	63.8	67.4	32.7	82.9	8.3	1.7
Paper	15.4	14.6	14.2	11.7	38.7	10.3	74.1	73.9
Textile	4.9	1.8	2.4	5.4	5.8	0.5	0.4	1.3
Plastic	7.6	9.0	8.4	7.5	9.1	4.2	9.8	20.7
Glass	4.4	4.3	2.8	1.3	4.1	0.3	3.3	1.1
Wood, Coco, Leaves	0.1	0.9	2.1	0.5	1.7	0.3	2.2	0.3
Leather, Rubber	0.3	0.5	1.1	1.4	1.2	0.5	0.0	0.0
Metal	2.1	1.4	2.4	1.5	3.0	0.7	1.6	1.0
Stone, Ceramic	3.1	1.0	1.0	0.5	1.9	0.2	0.0	0.0
Others (Ash, Soil)	2.7	4.3	2.0	3.0	2.1	0.3	0.5	0.0

Solid waste composition from high class to slum class shows gradual trends in garbage content increase from high class to slum class and conversely shows a decrease in paper content. Commercial waste composition has a low content of garbage and a high content of paper, thus its apparent specific weight is low. Building waste are mostly paper, the reason is that office workers consume paper through their office work, and supermarket refuse is only corrugated package cartons. Both building and supermarket waste has very low apparent specific weight.

(3) Chemical Analysis of Solid Waste

To obtain the combustion and composting conditions, chemical analysis was practiced as follows:

1) Moisture content

The sample was kept in a metallic bin at a temperature ranging from 90 to 100 degree Celsius for five days for drying.

Determination of the moisture content should be calculated by using the formula as follows:

Moisture Content (W%) = (A - B) / A x 100

A: Weight of the sample before drying

B: Weight of the sample after drying

2) Chemical analysis

After removing the incombustible materials, the sample dried at 105-115 degrees Celsius, and the sample was ground to the size of about 2-3 mm.

a) Combustible matters

The sample was heated at 800 Celsius for three hours in an electrical furnace.

Determination of Combustible matters are calculated by using the following formula:

Combustible Matters (V) = (A-b) / A x 100

A: Weight of sample before heating (grams)

B: Weight of sample heated at 800 Celsius (grams)

b) Carbon content

Determination Method was taken as follows:

The sample was put into a combustion tube and heated at 800 Celsius in an electric furnace. Combustion gas was absorbed in the absorption tube and the weight difference before and after absorption was noted.

c) Nitrogen content

Determination Method was by JIS K0102.
Analysis of Nitrogen was taken by the "Kjeldahl Method".

3) Seasonal change of waste composition

The study of solid waste during the rainy season (from August to September in 1990) had already been completed, but that of the dry season is now being done (from January to March). After finishing the studies of both seasons, the seasonal changes of waste composition can be obtained.

The results of analysis are as follows.

Table 1-1-4 Solid Waste Chemical Content* (1990, 1991)

(Wet Base %)

Item / Class	High	Middle	Low	Slum	Commercial	Market
Water content %	66.5	69.1	59.4	52.5	47.5	65.3
Combustible matter %	27.3	25.9	34.8	33.9	46.0	27.3
Ash %	6.2	5.1	5.9	13.4	6.6	7.5
T-N as N %	1.32	1.46	1.40	1.32	1.59	1.28
T-C as C %	10.84	10.67	13.44	10.97	19.29	11.51
C/N ratio	8.62	7.46	10.18	8.25	12.58	9.06
Lower heating value (kcal/kg)	830	753	1,209	1,364	1,933	835

H = 45V-6w
H: Lower heating value (wet base)
V: Combustible matters content (%)
W: Water content (%)

* Above samples do not contain noncombustible matter (glass, metal, stone, ceramic, etc.).

4) Discussion

a) Three components of refuse and heating value

Several class heating values were calculated according to analytical value.

Their range was 753 - 1,364 kcal/kg in lower heating value. Japanese average calorific value of domestic waste is 1,120 - 1,574 kcal/kg on average.

b) C, N content

By the study of waste analysis, C content of residential solid waste are 10.67 - 13.44% and N content are 1.32 - 1.46%. C/N ratio of the above wastes are 7.46 - 10.18.

It is said optimum C/N ratio of solid waste for compost is 35 - 50. C/N ratio of residential refuse of study area are rather low, and when C/N ratio is low, a lot of ammonia is produced and the resulting smooth biochemical decomposition of waste is delayed.

If C/N ratio is unbalanced, it is not easy to keep a good decomposition speed, but if it is long enough, the waste will become harmless manure, and environmental contamination by solid waste will be prevented.

1.1.3 Waste Quantity hauled to El Trebol site according to the field data and estimation

(1) Basic data for an estimated waste quantity

1) Collection vehicles by each sector
2) Trip number and average loading rate
3) Number of trucks incoming into El Trebol
4) Waste quantity hauled to El Trebol and its percentage

(2) Estimation of waste quantity collected

Data and information above mentioned have been carefully analyzed and compared with each other to determine the waste quantity collected, separated and hauled; the following table shows an estimated quantity

of solid wastes collected by each sector (Table 1.1.5).

From Table 1.1.5, some conclusions can be deduced; i.e.,

1) The number of trips shows a far lower value than expected, varying from 1.00 to 5.68. The highest trip number is 5.68 for the municipal convoy service.

2) The average loading rate decreased considerably, as weight measuring data came to accumulated and the hauled amount to the Trebol Landfill site showed a significant difference resulting from an aberration of an operational estimation carried out during the first field survey.

3) Not all operating collection vehicles which belong to the private sectors, Association and Cooperative, discharged their refuse loading in the Trebol site, causing thus a lot of illegal dumping sites. An illegal disposition amount attains 135 ton per a week day.

The following is an information for reference.

	No. of vehicles	Operating No. of vehicles	Incoming No. of vehicles	Total No. of trips
Association coll. vehicles	198	188	138	146
Wagons & carts	51	41	39	46
Cooperative	38	36	28	29
Independent	12	11	6	6

4) The total number of all vehicles incoming into the Trebol landfill per day is estimated 467 according to the field data shown in Table 1.1.5. To mitigate congestion phenomenon in the landfill sites, a new landfill site need to be opened urgently, because a traffic congestion occurs from 11 to 15 o'clock as Table 1.1.7 shows.

5) Of all waste amount, 1,375.75 ton/working day, domestic and non-domestic wastes should be clearly classified in order to evaluate an exact operating efficiency of each sector and to clarify relation between a generation quantity and collected amount of domestic wastes. The following results have been obtained from the analysis of the subsequent table: Results and Forecast of Population by Areas and Solid Waste Quantity.

. Generation amount in 1990, (Domestic waste only)	969.1 t/w.d
. Total domestic waste collected	
Municipal service (t)	45.12
Private service	
a. Association	498.71
b. Cooperative	91.34
c. Independent	13.33

6) The total domestic waste collected is 648.50 t/W.D

The breakdown of it is as follows;

a.	Recovered amount	30.17 t
b.	Illegally disposed amount	135.00 t
c.	Hauled amount to Trebol	483.33 t

7) 320.60t/W.D, the domestic waste non collected is equivalent to 506,700 population, if calculated based on the following equation,

$$\frac{320,600 \text{ kg/W.d}}{0.6327 \text{ PCDW}} = 506,717$$

8) Non-domestic waste quantity hauled to Trebol

Its total amount is 727.25 t/W.D and its details are as follows.

a.	Municipal operation	
	Routine collection service	159.24
	Convoy service	35.94
b.	Particular	
	Refuse (commercial and/or industrial)	105.86
	Earth & construction Debris	426.20

9) The total amount hauled to the Trebol, domestic and non-domestic is 1,210.58 t/W.D.

Earth, pend and construction debris occupies 35.21% of the waste amount to be disposed of. These materials can be utilized as cover material.

1.1.4 Time Schedule for Granting Concessions

In order to decide a reasonable and convincing sequence order of concession-granting, it will be necessary to consider the following conditions, such as

1. A gradual plan of granting concessions exclusively to the collectors registered as of Dec., 1990;

2. A concession priority to zones covering the Easy collection Areas (E.C.A.), not excluding, however, zones in PCA (Possible Collection Areas);

3. A reasonable assurance for profitability;

4. An avoidance of conflicts between private collectors;

5. A practicable contribution for eliminating existing illegal open dump sites.

A comparative table has been, therefore, elaborated to decide a tentative order of concession.

Zone specification		Profitability (Case A)	Open dump sites	Conflict among collectors			Tentative concession order
				D.R.P.	A	C	
ECA Zone	1	19.09	-	1	?	3	4
	2	22.61	21	3	"	2	4
	3	19.04	14	13	"	2	4
	4	-8.30	17	0	"	2	4
	5	4.20	33	9	"	3	2
	6	9.23	46	54	"	6	2
	7	30.45	86	34	"	5	5
	8	-3.65	12	1	"	4	3
	9	17.23	8	0	"	3	3
	10	64.36	14	0	"	2	3
	11	48.33	30	5	"	12	1
	12	47.43	9	9	"	11	2
	13	45.88	23	2	"	3	5
	14	62.93	17	2	"	3	5
	15	60.74	21	0	"	3	5
PCA	18	16.94	48	59	"	7	
	19	-1.54	2	6	"	3	
	21	25.98	?	1	"	1	
MIXCO		1.38	Abundant	14	"	14	

Code: DRP = Dwelling residence place
A = Association
C = Cooperative

Judging by their various conditions according to comparative elements, it will be reasonable to adopt the following order of concessions.

1992	Zona	11
1993	Zonas	5, 6, 12
1994	Zonas	8, 9, 10
1995	Zonas	1, 2, 3, 4
1996	Zonas	7, 13, 14, 15

Concession granting in Zona 18, 21, and Mixco City will reduce the number of open-dump sites drastically and improve collection coverage, thus resulting in a good contribution to environmental preservation.

Table 1-1-5 Waste Quantity Collected, Separated and Hauled

		Estimated No. of Vehicles (No./day)	Average Trip Number	Loading Rate (t/Vehicle)	Hauled Amount to Trebol (t/W.D)	Illegal Disposition Amount (t/W.D)	Recovery Amount	Total Amount Collected (t/W.D)
1	Municipal							
	Ball Coll. Service	35 (T-1)	1.21 (T-2)	3.76 (T-2)	159.24			159.24
	Convoy Service	3 (T-1)	5.68 (T-2)	2.11 (T-2)	35.95			35.95
	Bell Coll. Service	12 (35/3)	1.00	3.76	45.12			45.12
	(Sub-total)				(240.31)			(240.31)
2	Association							
	Coll. vehicles	138 (T-3)	1.06 (T-2)	2.31 (T-2)	337.91	(188-138) x 2.31=115.5	23.86	477.27
	Carretas	39 (%-3)	1.06 (T-3)	0.47 (16T-1)	19.43	(41-39) x 0.47=0.94	1.07	21.44
	(Sub-total)					(116.44)	(24.93)	(498.71)
3	Cooperative	28 (T-3)	1.05 (T-2)	2.32 (T-2)	68.21	(36-28) x 2.32=18.56	4.57	91.34
	(Sub-total)				(68.21)	(18.56)	(4.57)	(91.34)
4	Independent	6	1.05 (T-2)	2.01 (T-2)	12.66	-	0.67	
	(Sub-total)				(12.66)		(0.67)	(13.33)
5	Particular (Refuse)	79 (T-3)	-	1.34 (T2x2/3)	105.86	-	-	105.86
	(Earth, Debris)	77 (T-3)	1.35 (T-2)	4.10 (T-2)	426.20			426.20
	(Sub-Total)				(532.06)			(532.06)
	Total				1,210.58	135.00	30.17	1,375.75

2. Financial Aspect

Contents

1. Socio-Economic Conditions

1.1 Economic Condition

(1) GNP and its components

GNP is one of the famous indices that show the economic situation of a country. Guatemala GNP transition, from 1976 to 1988, is summarized on tables 3-1 to 3-3, containing components of GNP, such as consumption, capital formation, exports, imports and factor income. GNP and its components on table 3-1 are measured by constant price at 1958, table 3-2 by current price and table 3-3 shows deflators of GNP and each components. These tables suggest the following:

a. GNP growth rates (constant price) for every five years recently are shown below.

1976 - 1980	5.0% per year	
1980 - 1985	-1.3%	"
1985 - 1988	3.2%	"
1989	4.0%	"
1990	4.0%	" (estimated)

Guatemala's economy has been surely recovering since 1985, under democratic government.

b. On a view of GNP structure, big consumption and small capita formation is specialized. It is guessed that supply capacity of industrial goods is especially limited by small capital stock, like equipment and erection.

c. Next export (export - import) valued by constant price has given surplus, but by current price shows deficit. It is indicated that import price index has largely increased and was about two times of

export price index, at 1988.

d. Factor income

GNP is defined as GDP less factor income. This factor income contains foreign transfer incomes like incomes gained by foreign companies or peoples in Guatemala. The factor income has been occupying about 10% of GDP and probably this 10% must be bigger.

e. GNP deflator has increased as shown below.

1976 - 1980	10.6%
1980 - 1985	8.2%
1985 - 1988	18.9%

What worry us is that inflation has been expanding recently, based on high import prices.

(2) Price conditions

Consumer price index (CPI) has been changing as shown below:

	83	84	85	86	87	88	89	89/83 (%)
CPI	106.0	107.4	128.0	169.9	188.4	207.8	234.7	14.2

Note: April, 1983 = 100

Because government subsidies and differences of concept, growth rate of CPI is low, less than that of consumption deflator.

(3) Labor Condition

Based on number of employee and employee's income in the industrial sector, annual average wages by sector

are calculated (refer to tables 3-4, 3-5 and 3-6). According to these information, it is indicated the following:

a. Employees share from total labor force seems to be small. In other words individual worker have a bigger share of it.
b. Total employee's income occupied only about 13% to current GNP, in 1988.
c. Wage seemed to increase following inflation.
d. Wages in commercial and electricity sectors have been higher than agriculture sector.
e. Movement of labor force from low wage sector to middle wage sector except commercial and service sectors, shall be important for Guatemala's economical improvement. But improvement of social conditions, for example security, education and etc. should be needed.

Unemployment rate is shown below.

1985	36.4%
1986	37.8%
1987	37.3%
1988	36.7%
1989	36.0%

Demand-supply conditions on labor field has not been changed, because industrialization has been delayed.

(4) Industrial Structure

According to table 3-7, it is understood that agriculture and commercial sectors have been large production sectors, followed by the manufacturing sector. Guatemala fully depends on agricultural production and marketing, not industrialization.

(5) External Trade

1) Exports

Agricultural goods, such as coffee, sugar, banana, cotton and cardamom are Guatemala's main export goods.

These goods are easily influenced by demand-supply conditions in international commodity market and natural conditions (climate). This means that Guatemala cannot control its prices and production amount. Also these goods cannot be stocked in a warehouse. Therefore, it is clear that export situation is very unstable, but Guatemala's economy fully depends only on exporting these goods (refer to tables 3-9).

2) Imports

On the other hand, main import goods are consumer's goods primary materials for industry and capital goods recently, especially primary material imports for industry have increased rapidly. This means that basic industries, like iron, steel, pulp, refineries, chemical and cement are insufficient (refer to table 3-10).

3) Exchange rate

In general, exchange rate is decided by demand-supply of currency, Quetzal and US dollar. In recent years imports has always been bigger than exports, this means demand of US dollar for payment of import in Guatemala has been increasing. With this background, Quetzal has been depreciating to US dollar slightly (see below), and the exchange

rate is around 6.0 Q/US$, at the end of September, 1990.

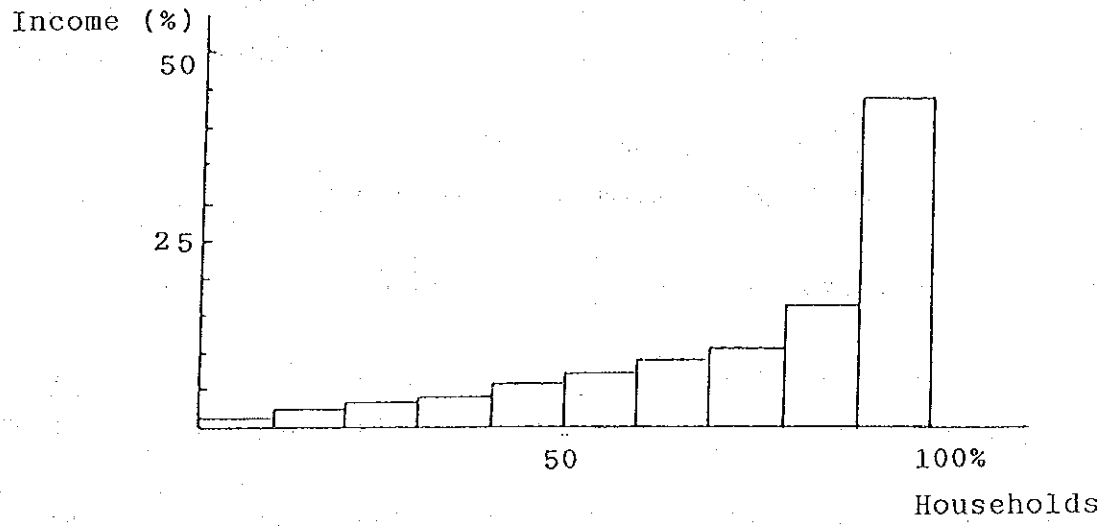
Variation of Exchange Rate

	85	86	87	88	89
Depreciation	29%	28%	26%	26%	28%

Note: Variation rate depreciating to previous year

(6) Income distribution

Information of income distribution is shown as follows.



Above figure indicates that 10% of total households gains 44% total income of Guatemala. Guatemala has to improve this situation.

(7) Economic forecasting up to year 2000

GDP of Guatemala has been growing by 5.0% per year based on increasing exports and capital formation, from 1988. However, import shall be increased by the influence of GDP's expansion and the exchange rate will depreciate because unbalance demand-supply situation

between Quetzal and US dollar, and GDP shall saturate it with inflation. This is the economic structure of Guatemala. Therefore, 2 to 3% per year as GDP growth rate might be estimated adequately.

1.2 Social Condition

(1) Population engaged with economic activity

Population number engaged with economic activity in 1989, 10 years old and up, is summarized below.

Sex	Occupation	No. of occupation	Inactivity	Total
Male	2,123,764	34,635	648,030	2,806,429
Female	716,594	23,323	2,283,886	3,023,801
Total	2,840,358	57,958	2,931,916	5,830,230

Note: 1) Unit = Person
2) People objected more than 10 olds

Next, above occupation is studied in details.

Sex	Employee	Individual	Employer	Home	Total
Male	1,012,604	708,406	34,054	368,700	2,123,764
Female	368,468	239,329	8,026	100,771	716,594
Total	1,381,072	947,735	42,080	469,471	2,840,358

Furthermore, population number in each income grade and in each education grade is shown as follows.

Income (Q)	Employee	Individual	Employer	Total
0 - 49	77,865	277,045	1,248	356,158
50 - 99	187,532	218,562	501	406,595
100 - 149	303,265	137,835	1,930	443,030
150 - 199	221,715	83,500	1,741	306,956
200 - 299	218,277	96,917	4,585	319,779
300 - 399	142,724	51,461	3,359	197,544
400 - 599	145,481	41,963	7,689	195,133
600 - 999	56,534	24,322	7,150	88,006
1,000 - 1999	23,265	11,753	6,041	41,059
2,000 - more	4,414	6,377	7,836	16,627
Total	1,381,072	947,735	62,080	2,370,887

Note: 1) = Income shows monthly income.
2) = Without home workers

Education	Employ	Individual	Employer	Home	Total
No instruction	359,875	474,926	3,441	183,443	1,021,885
Primary (1-3)	326,298	254,063	8,011	142,388	730,760
Primary (4-6)	354,208	152,506	12,959	121,886	661,617
Secondary (1-3)	104,865	29,839	3,296	14,283	152,761
Secondary (4-7)	156,519	24,188	8,257	6,305	195,269
Univer. (In comp)	48,065	5,768	2,770	1,166	57,769
" (Comp.)	31,262	6,387	2,848	-	40,497
Total	1,381,072	947,735	62,080	469,471	2,840,358

(2) Transportation and Telecommunication

Automobile has been the main transportation, especially urban. Then, air and sea services has been stably increasing from 1985, but their share has been too small, compared to automobile, communication, including mail and telecommunication has also been increasing stably.

These functions are basic for industrial activity and daily home life (refer to table 3-11).

(3) Electricity and water supply

1) Electricity

Sources of generation have been changing from oil generation to hydrologic generation and its amount has been expanding stably from a consumption point of new resident and commercial sector has increased and industry sector also, but its shares have been decreased.

Electricity price has been inflating slowly, but less than CPI.

2) Water Supply

Charged water supply has been increasing slowly (refer to table 3-12).

1.3 Summary

Socio-economic conditions are summarized as follows.

a. Based on good export situation and expansion of capital formation, GDP has been growing stably in 1989 and 1990.

b. Agricultural goods, like coffee, banana, sugar and so on, have been and shall be essential export and strategic goods. Prices of these goods are decided at international market (Guatemala cannot control these prices) and production amounts fully depends on land size and weather (Guatemala cannot control production amount).

c. On the other hand, consumer's goods, primary materials for industry and capital goods largely

depend on imports, also foreign goods. It means that import always increase tendingly.

d. One serious domestic problem is inclination of income. According to information of income distribution, small part of people gains large part of income.

e. It is necessary, therefore, to improve economic structure of Guatemala, in the details shown below:

- Diffusion of education
- Labor movement from agriculture sector to industry sector
- Increase of capital formation and expansion of production capacity
- Also expansion of social basic stock, like electricity, transportation and ports.
- Industrialization and decrease of import goods.

2. Financial Condition for the Municipality

For managing waste collection in markets, slams and peripheral area of Guatemala City, where private collectors cannot collect waste for economical reasons, budget amount of Municipality is important. Therefore, financial situation of Municipality is investigated below:

2.1 Financial Structure

Income sources of Municipality consist of 2 roughly items:

Current and Capita: Current contains indirect taxes and others. Capital involves transference from Government and others.

On the other hand, payment applications consist of several expenses such as personnel cost, materials and supplies cost, financial expenses, investment expenses and so on.

Additionally, cash balance is taken place as Municipalities finance buffer. Cash balance is considered of several differences between incomes and payments carried over the years. Capital portion has been large in cash balance consumed for machine procurement and building construction.

Figure 3-1 shows the financial structure in 1989.

2.2 Source of Funds

(1) Composition

Income composition is mentioned as follows.

a. Current Income
- Taxes = Beer, cigarette, gasoline, vehicle export of coffee and so on
- Semi-Taxes = Surviving pension
- Non-Taxes = market flat, patrimonial, diversing contribution and so on
- Transference = Personnel improvement, salary increase of central government and so on

b. Capital Income
- Sales of fixed assets etc. = Land for industry
- Public Credit = Debts from bank
- Transference = Donation, central government and so on.

Current income might be used for payment of personnel, material and debt service, then Capital income is used for purchase of equipment and machinery and building construction.

Figure 3-2 shows the income structure of Municipality for 1989.

(2) Situation

Income transition of Municipality is summarized as follows.

(1,000 Q.)

	86	87	88	89	89/86 (%)
Current					
Taxes	16,596	21,551	26,246	24,418	13.7
Semi-Taxes	21	50	44	47	30.8
Non-Taxes	5,849	7,828	10,538	11,372	24.8
Transference	5,551	7,995	10,655	9,359	19.0
Total	28,017	37,424	47,483	45,196	17.3
Capital					
Sales of Fixed Assets	0	0	1,203	500	*
Public Credits	207	316	3,017	5,499	198.4
Transference					
Government	10,608	14,792	5,263	5,313	-20.6
Others	50	5	303	231	66.6
Total	10,658	14,797	5,566	5,544	-19.6
Total	10,865	15,113	9,786	11,543	2.0
Total	38,882	52,537	57,269	56,739	13.4

The following things are indicated:

a. Total income increased at 13.4% yearly, from 1986 to 1989, as following Guatemala's economic recovery.

b. Current income has occupied big share of total income and might be occupying even more.

c. Capital income has been increased slightly for the same period according to rapid reduction of transferences from government.

d. Public credits increased from 1988, because lack of capital income.

2.3 Application of Funds

(1) Composition

Composition of payment by uses is shown as follows.

a. Personnel expenses
b. Non-personal expenses
c. Materials and supplies
d. Machines and equipment
e. Acquisition of real estate and existing equipment
f. Construction, extension and improvement by contract
g. Transference of current
h. Transference of capital
i. Financial payment
j. global grant

Payment is also composed by another form, as follows.

- Current payment

a. Consumption
b. Expense for finance
c. Transference

- Repayment of debt
- Capital payment

Figure 3-3 shows the payment structure for 1989.

(2) Situation

Payment transition from Municipality is summarized as follows:

a. by use

(1,000 Q)	86	87	88	89	89/86 (%)
Personnel	13,782	16,306	18,317	19,509	12.3
Non-personnel	4,187	4,286	6,294	7,049	19.0
Materials	2,913	6,854	6,406	7,717	38.4
Machinery	365	1,086	1,942	6,100	155.7
Acqus. real estate	0	0	375	452	*
Construction	0	5,003	1,830	4,950	*
Trans. Current	7,643	8,363	11,968	12,273	17.1
Trans. Capital	0	0	0	265	*
Financial Payment	2,700	2,998	3,240	2,746	0.6
Global grant	14	69	370	599	249.8
Total	31,604	44,967	50,743	61,660	25.0

b. by another form

(1,000 Q)	86	87	88	89	89/86 (%)
Current					
Composition	18,462	21,837	28,360	28,049	15.0
Expense with finance	381	284	327	393	1.0
Transfer	4,106	3,529	4,386	6,294	15.3
Total	22,949	25,641	33,073	34,736	14.8
Debt Service					
Payment	2,701	2,989	3,208	2,746	0.6
Capital Expense	5,944	16,335	14,462	24,178	59.5
Total	31,604	44,965	50,743	61,660	25.0

According to tables above:

- Personnel cost share from total payment has been decreasing 44% to 43%.
- On the other hand, capital expense has been rapidly increasing.

- Expenses for purchasing material and supplies also has been increasing.

2.4 Cash Balance

Difference between source of funds and application of funds, has been generating recently, as follows.

(1,000 Q)

	86	87	88	89
Current income	18,017	37,424	47,484	45,196
Current expense	27,623	36,635	41,010	43,548
Difference	394	789	6,474	1,648
Capital income	10,865	15,113	9,786	11,543
Capital expense	3,981	2,207	4,607	8,891
Difference	6,884	12,906	5,179	2,652
Project under exe.				
Carry from previous year	0	7,278	14,850	21,377
Expensed amount	0	6,123	5,126	9,221
Difference	0	1,155	9,724	12,156

Note: Carry from previous year is defined as an addition of all three difference above at previous year.

The difference generated at capital portion were largely various depending on product's actual implementation.

Three total difference were carried over to next year in order to pay functional and capital payment.

2.5 Direction of Public Services

Municipality is formed by five directions, two generals and two units, as shown below.

a. Direction
   Administration Service
   Public Service
   Works
   Transportation
   Finance

b. General
   Secretary
   Administration

c. Unit

   Institutional Development
   Urban Planning

Department of Public Cleansing, as a counterpart of the project, belongs to the Direction of Public Service, with other departments mentioned below.

a. Education and Culture
b. Fire Service
c. Municipal Health
d. Public Cleansing
e. Market
f. Environment Health
   and so on.

Actual payment of Municipality's Public Service occupied about 20 to 21% of total expense.

YEAR	PUBLIC SERVICE (A)	TOTAL MUNICIPALITY (B)	SHARE (%) (A)/(B)
1986	6,208	31,604	19.6
1987	8,927	44,965	19.9
1988	11,380	50,742	22.4
1989	15,734	61,661	25.5
Growth Rate	36.3%/year	25.0%/year	

Note: Unit = 1,000 Q.

Furthermore, the payment increased by 36.3% yearly from 1986 to 1989, more than Municipality's total, transition of detailed information related with expenditure of Direction of Public Services is mentioned below.

(1,000 Q)	86	87	88	89	89/86 (%)
Functional Payment					
Personnel	3,745	4,224	4,942	5,033	10.4
Non-personnel	2,049	2,348	3,398	3,389	18.3
Material, etc.	391	636	734	1,067	39.7
Machinery & equipment	1	40	22	81	*
Financial payment	-	544	-	-	*
Global subsidy	-	3	7	113	*
Total	6,186	7,795	9,103	9,683	16.1
Investment Payment					
Personnel	22	25	16	17	17.5
Non-personnel	-	194	341	539	66.7
Materials etc.	1	13	86	115	197.4
Machinery & equipment	-	314	1,059	3,810	248.3
Construction	-	586	775	1,490	59.5
Global subsidy	-	-	-	80	*
Total	23	1,132	2,277	6,051	131.2
Total	6,209	8,927	11,380	15,734	36.3

Note: Growth rate of each item in investment payment calculated for 1987-89.

The followings are cleared by above information.

a. Personnel costs has been increasing slowly.
b. Materials and supplies has been increasing stably.
c. Machinery, equipment and construction has been increasing rapidly.

2.6 Summary

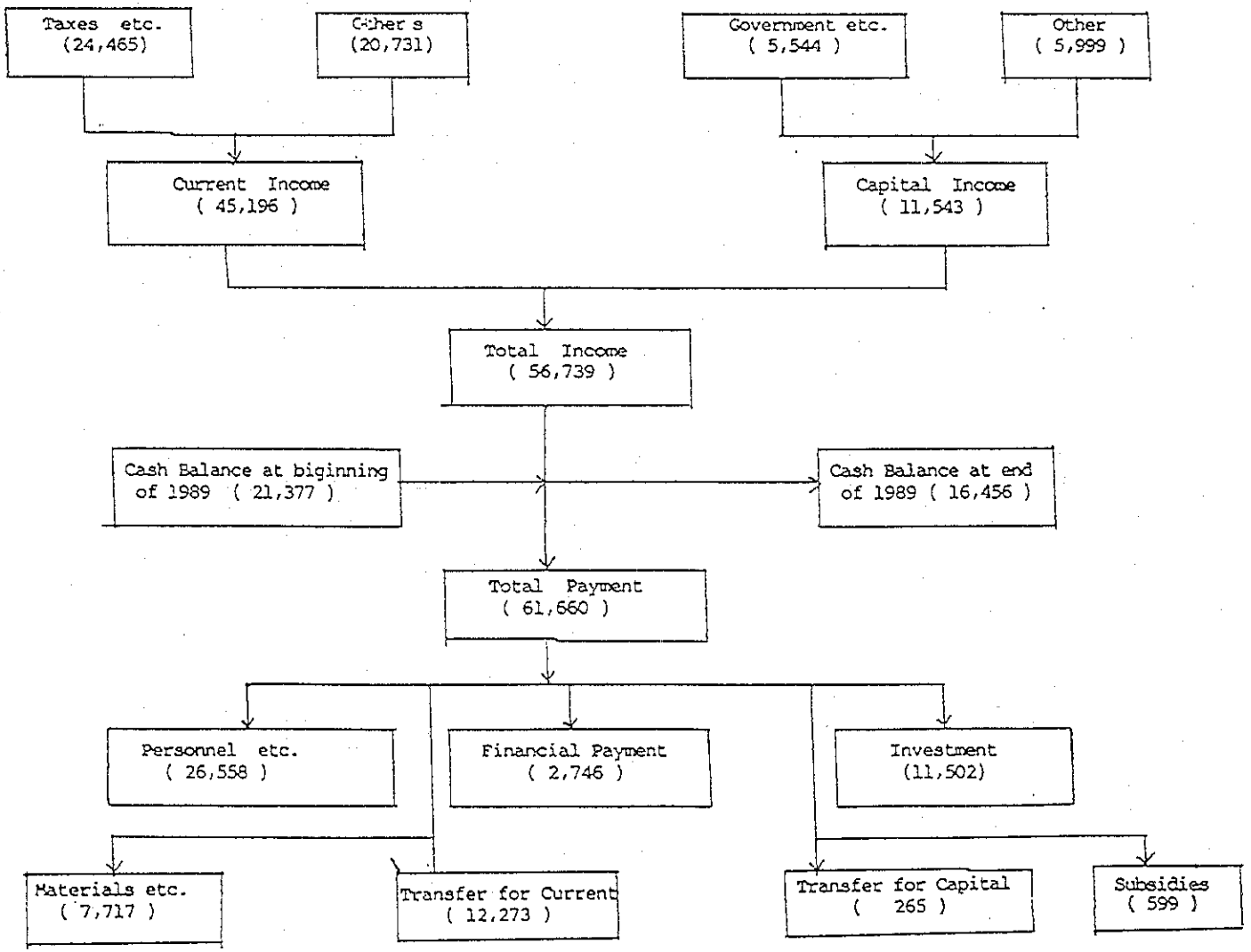
- Expenditure of Municipality increased by 25.0% per year, 1986-89, more than income only 13.4% per year. However, deficit has not been occurred because of the existence of cash balance defined as the difference between income and expenditure, according to irregular income increase.

- The expenditure consist of two roughly parts that are named Current and Capital. Current means ordinary expenses, like personnel costs, materials and supplies costs, financial expenses and so on. On the other hand, Capital means investment expenses, like machinery, equipment and building construction, Capital portion increased rapidly, at 59.5% per year.

- Composition of income corresponds to its expenditure.

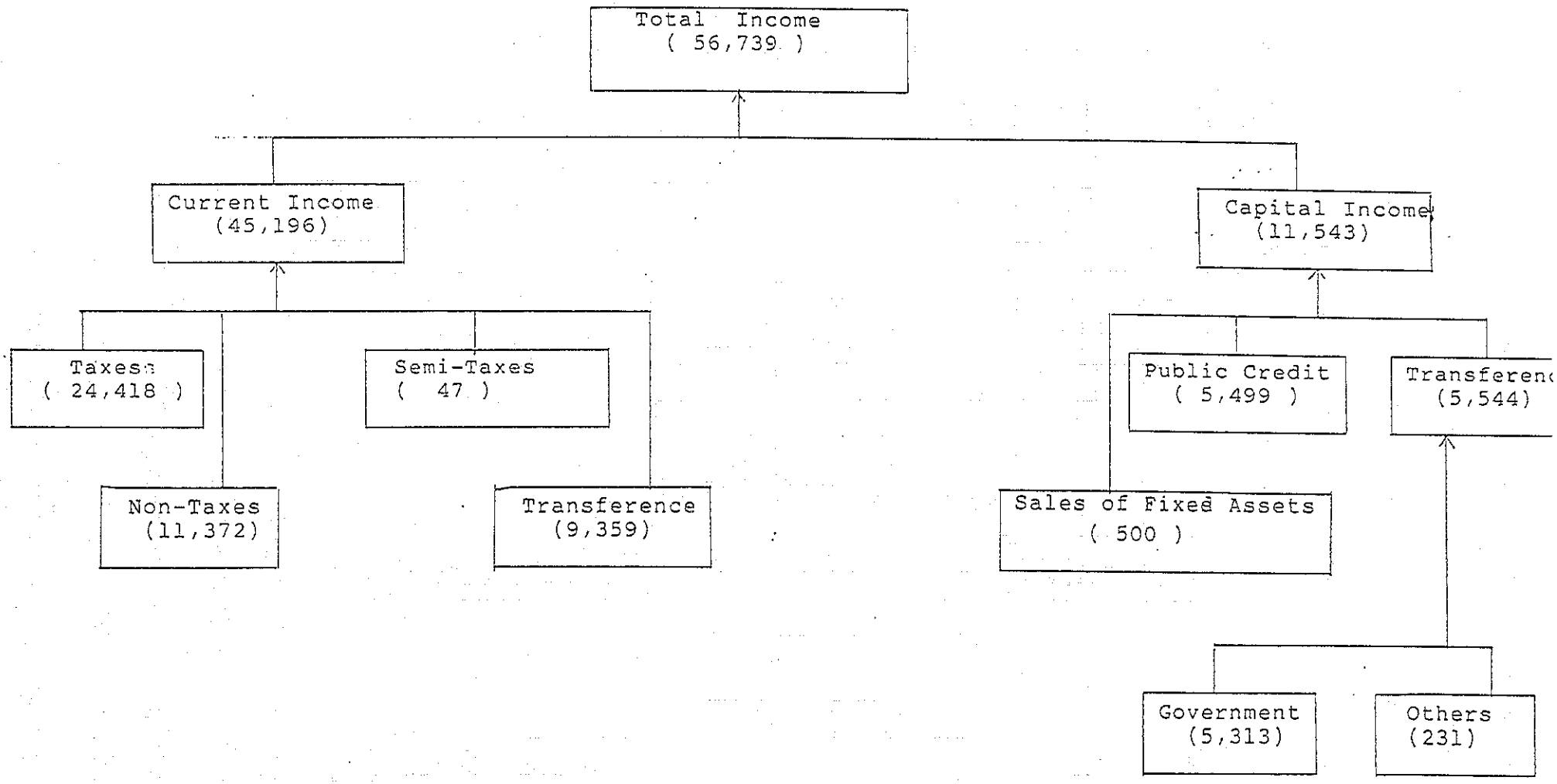
Current income consist of tax revenues, non-tax revenues and Government transferences. Capital income is mainly composed of public credit, and also government transference. The financial problem is insufficiency of Capital income growth, increased at only 20% per year the last four years.

- Compare expenditure of Direction of Public Service including Department of Public Cleaning, increased at 36.3% yearly. To municipality's total expenditure with a 25.0% annual growth rate. Especially, the Capital portion increased extremely.



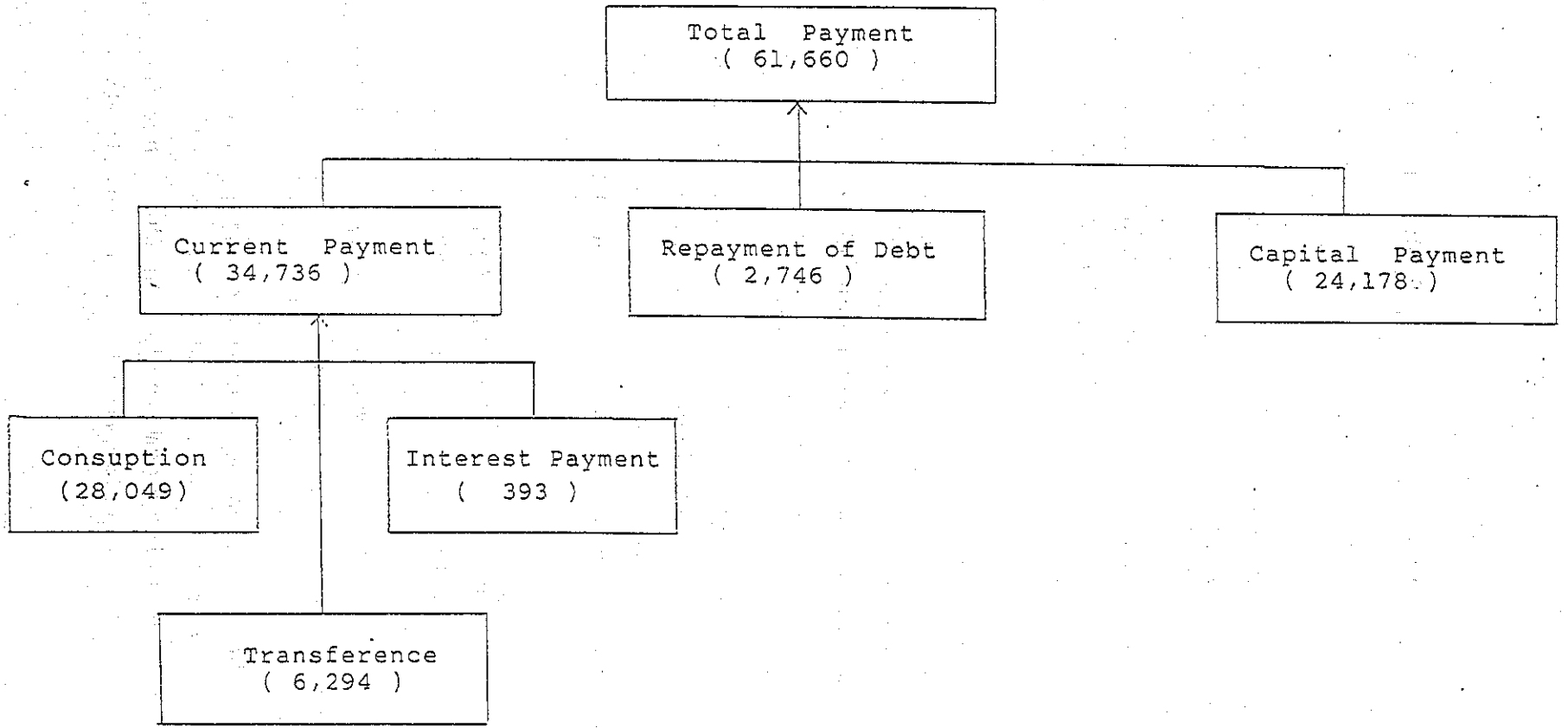
Note 1: ( ) shows value at 1989
" 2: Unit = 1,000 Q

Figure 2-1 Income and Payment Structure of Municipality



Note 1: ( ) shows value at 1989
" 2: Unit = 1,000 Q

Figure 2-2 Income Structure of Municipality



Note 1: ( ) shows value at 1989
" 2: Unit = 1,000 Q

Figure 2-3 Payment Structure of Municipality

3. Financial Condition for the DLPM

3.1 Cost Structure

First the cost structure by functions of DLPM is shown as follows from 1988 to 1990.

		88	89	90
a.	Administration and others	5.8	6.0	5.5
b.	Sweeping and collection	85.7	85.6	84.8
c.	Final disposal	5.5	5.4	6.3
d.	Maintenance and Repair	3.0	3.0	3.4
e.	Total	100.0	100.0	100.0

(Unit: %)

Above figures indicate:

a. Sweeping and collection service consumed 85% of DLPM's budget. Especially, sweeping shared 45% of it.
b. Shares of final disposal and maintenance and repair were extremely low.
c. Consequently, sanitary landfill has not been installed and vehicle availability has been insufficient.

Unit costs of collection and disposal is calculated as follows.

		(1,000 Q.)	(1,000 t)	(Q/r)	($/t)
a.	Sweeping	1,865	5.3	296	74
b.	Collection	3,132	69.0	45	11
c.	Final Disposal	737	420.0	1.75	0.44

(Exchange rate = 4 Q/$ as of 1990)

It is apparent that the cost of the sweeping service is high as it represents more than half of the cost of the sweeping and collection services combined. On the other hand, the unit cost of the final disposal was definitively low.

However, the growth rates of final disposal and maintenance and repair have increased largely from 1988 to 1990, so that their situation seems to have improved slightly (refer below).

		88-90
a.	Administration and others	36.5
b.	Sweeping and collection	41.2
c.	Final Disposal	62.2
d.	Maintenance and repair	62.8
e.	Total	42.7

(Unit: %)

Next, another cost structure by type of expense is shown as follows:

		88	89	90
a.	Personnel cost	77.6	77.2	75.3
b.	Material cost	19.5	21.9	22.7
c.	Machine and equipment	0.9	0.9	2.0
d.	Total	100.0	100.0	100.0

The share of machinery and equipment has been quite low. Since the sweeping service by DLPM has the policy of hire poor people to help the unemployed, this service must be continued.

The fuel and lubricant costs have represented a large portion of the cost of material and the double increase of machine and equipment in 1990 was brought by the budget expansion in maintenance and repair.

3.2 Budget IN 1991

In 1991, the sector of DLPM that was responsible for maintenance of vehicles including fuel supply, has been transferred to the division of maintenance for machine and vehicles. So DLPM's budget has decreased as follows:

	1990	1991
DLPM's	5,734	5,262

(Unit: 1000Q)

But the budget of personnel and materials transferred from DLPM is Q. 1,412,780, so that the total budget concerned with DLPM's activities becomes Q 6,674,340. The growth rate for 1990/1990 is calculated as 16.6%, and a portion of the total municipal budget is 9.7%. It is recommended that the portion should be increased in the following years for the improvement of sanitary condition in the study area (refer to table I-3-9).

Table I-3-9 Transition of SWM's Budget

	1988	1989	1990	1991	19/88
SWM					
DLPM	4,003	4,186	5,250	5,114	--
Relleno Sanitario	398	787	474	148	--
Other Sector	-	-	-	1,412	--
Total (a)	4,401	4,973	5,724	6,674	--
Municipality (b)	47,484	45,196	55,283	68,560	
Share (a/b, %)	9.3	11.0	10.4	9.7	-
Growth of a (%)	-	13.0	15.1	16.6	14.9
Growth of b (%)	-	-4.8	22.3	24.0	13.0

4. Financial Condition for Private Collectors

As mentioned before, private collectors are gathering solid waste from most of households, commercial stores, small factories and medical clinics and gain some money from customer's collection fee. This thing indicates that their existence is very important for solid waste collection in Guatemala Metropolitan Area and their business must be stable. However, at present, private waste collectors are managing their activities selfishly and most of them are only joining unions, named Association and Cooperativa. Association is a crowd of people and Cooperativa is a union with collaboration among people. Therefore, management information for private collectors probably doesn't exist.

However, Cooperativa has been holding a plan to establish a corporation and manage it for solid waste collection and submitted a prefeasibility study report to Municipality. A meeting between JST and two unions was held for investigation with actual condition of collection and management. So then, the pre-F/S report and the meeting results are analyzed as research of financial condition of private collection.

4.1 Analysis for Pre F/S report

Cooperativa is now attempting to establish a corporation, organize all members as employees and manage it for purchasing new vehicles and improving individual activity by each member of Cooperativa.

Cooperativa is now requesting a concession to Municipality, for waste collection in zones 3, 7, 8, 11, 12, 13, 19, 20, 21 and 22. To achieve its new business, Cooperativa made a projection report regarding this matter and submitted to Municipality. Municipality is now holding it for preparing answer to this request.

(1) Premise

Assumption for the prefeasibility study is summarized as follows:

a.	Number of customers served	= 200,000 households
b.	Average collection fare	= Q. 6.00/client, month
c.	Other revenues	= Q. 22,500/year
d.	Total number of manpower	= 555 persons
e.	Total personnel cost	= Q. 222,200/month
f.	Maintenance and repairs	= Q. 500/vehicle, month
g.	Fuel and Lubricants	= Q. 200/vehicle, month
h.	Other expenses	= Q. 866,176/year
i.	Capital costs for 100 new vehicles	= Q. 5,750,000
j.	Capital costs for other equipment	= Q. 25,000
k.	Condition of borrowing money from bank	= Amount Q. 15,750,000 Grace no Repayment 5 years Interest 1.85%/month
l.	Paid-in share capital	= Q. 25,125

(2) Results

Although the pre-F/S report indicates projection results of Cooperativa financial situation based on the assumption mentioned in (1), some mistakes might be included in this projection. These are calculations of interest payment because interest payment of each year doesn't reduce following to decrease of principle. Table 3-13 appears exact financial statements, including after improvement of this interest calculation. According to table 3-13 including income statement and cash flow statement, this plan shall be achieved probably by the following facts.

a. Profitability
Net profit, from 1st to 5th year, shall be generated from 2 million to 3 million Q. and from 6th to 10th year, 3.3 million Q. every year.

b. Cash flow
Surplus cash shall be produced more than 3 million Q. every 10 years.

c. Assets
Current asset, mainly cash and savings in bank, shall be more than 70 million Q. at the end of 10th year. This means Cooperativa shall be able to obtain new vehicles by itself.

d. Investment Efficiency
Internal rate of return (IRR) is one of indices indicating investment efficiency. According to calculation by Cooperativa, investment plan efficiency shows very high, because more than 40% of IRR.

However, some optimistic assumptions are found. For example,

a. Number of customers are assumed as 200,000. This figure is too big. Starting from 27,000 households are served by Cooperativa at present.

b. 22.2% of annual interest rate is slightly low, because 25-30% of annual interest rate is reasonable at present and future.

c. No experience of management. Recruit of expert manager is important for Cooperativa.

Therefore, for investigation of influence, variation might occurred in the future, sensitivity study has to be attempted. For example:

ITEM	BASE VALUE	SENSITIVITY
a. Number or customers	200,000 households	less 20%, less 50%, less 75%
b. Fare for collection	Q.6.00/customer	Q.5.00/customer
c. Price of vehicle	Q.175,000/vehicle	more 10%, more 20% (for fluction of exchange rate)
d. Interest rate	22.2%/year	25%, 30%

By results of sensitivity analysis, above mentioned, feasibility of new business should be cleared more exactly and key items also indicated for achievement of business.

Table 2-14 Projection of new business plan by Cooperativa (1,000 Q)

Year	0	1	2	3	4	5	6	7	8	9	10
-Income Statement-											
Revenue											
Collection for household		14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400	14,400
" for other		22	23	22	23	22	23	22	23	22	23
Total		14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423
Operation Costs											
Personnel		2,666	2,667	2,666	2,667	2,666	2,667	2,666	2,667	2,666	2,667
Maintenance		600	600	600	600	600	600	600	600	600	600
Fuel		240	240	240	240	240	240	240	240	240	240
Other		1,088	1,088	1,088	1,088	1,088	1,088	1,088	1,088	1,088	1,088
Total		4,594	4,595	4,594	4,595	4,594	4,595	4,594	4,595	4,594	4,595
Interest Payment		3,497	2,797	2,098	1,399	699	0	0	0	0	0
Depreciation		1,577	1,578	1,577	1,578	1,577	1,578	1,577	1,578	1,577	1,578
Gross Profit		4,754	5,453	6,153	6,851	7,552	8,250	8,251	8,250	8,251	8,250
Reserve		2,852	3,272	3,692	4,111	4,531	4,950	4,950	4,951	4,951	4,950
Net Profit		1,902	2,181	2,461	2,740	3,020	3,300	3,300	3,300	3,300	3,300
-Cash Flow Statement-											
Source of Funds											
Revenue	0	14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423
Borrowing money	15,750	0	0	0	0	0	0	0	0	0	0
Paid-in Capital	25	0	0	0	0	0	0	0	0	0	0
Total	15,725	14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423	14,422	14,423
Application of Funds											
Capital Costs											
Vehicles	15,750	0	0	0	0	0					
Other	25										
Total	15,775										
Operation Costs	0	4,372	4,373	4,372	4,373	4,372	4,373	4,372	4,373	4,372	4,373
Debt service payment											
Interest	0	3,497	2,797	2,098	1,399	699	0	0	0	0	0
Repayment	0	3,150	3,150	3,150	3,150	3,150	0	0	0	0	0
Total	0	6,647	5,947	5,248	4,549	3,849	0	0	0	0	0
TOTAL	15,775	11,019	10,320	9,620	8,922	8,221	4,373	4,372	4,373	4,372	4,373
Surplus Cash	0	3,403	4,103	4,802	5,501	6,201	10,050	10,050	10,050	10,050	10,050
Accumulate surplus cash	0	3,403	7,506	12,308	17,809	24,010	34,060	44,110	54,160	64,210	74,260

4.2 Management Problems

At the meeting with unions of private collectors, Association and Cooperativa, their management problems were studied using a questionnaire provided by JST. They are summarized as follows:

QUESTION ITEMS	ANSWER ASSOCIATION	COOPERATIVA
Quality of helper	middle	middle
Payroll for helper	low	low
Necessity for increase of helper	no	no
Vehicle condition	middle	bad
Necessity for new vehicle	yes	yes
Money procurement	external	external
Interest rate	too high	too high
Tariff for collection	low	low
Request to Municipality	yes	yes

1. With employees (helpers), it seems to be no problems. They can accept low salary because earnings from scavenging.

2. With equipment (vehicles), some vehicles have been used for 25 to 30 years, changing their engines several times. Their conditions are so bad obviously. But private collectors can't purchase new vehicles to substitute the old ones. The reason is shortage of own money and no procurement of external money, because of high interest rate, for example 5 to 15% per month, in case of local money changers, not official banks.

3. With collection charge rate (fare), private collectors are thinking of low fares. But they can't raise it, because of severe competition among themselves.

4. With requirement to municipality, in case of Cooperativa, it is to ask for concession for the proposed collection areas and to obtain it from municipality as soon as possible. On the other hand, Association have many complaints to municipality for example, collection by municipality in low and middle income areas, rough land condition in Trebol site, an unuseful truck scale, containers and no assistance from municipality. It is guessed that the collection by municipal trucks in low and middle are is done with an irregular schedule.

4.3 Summary

Private collectors are clearly the central activity on solid waste collection in Guatemala Metropolitan Area. However, they are collecting waste selfishly, under no management by municipality, for example, zoning, routing, rating and policy. Therefore, it is necessary that management systems in private collectors must be improved with guidance of municipality like a plan submitted by cooperativa to establish a corporation, to organize it, and to manage sales promotion, collection, fare recovery and improvement of personnel conditions. This might be one of improvements as a future of private collection.

5. Debt Condition for the Municipality

(1) Sources

The municipality is procuring money for investment, purchasing equipment and building facilities from the following banks.

a. BCIE: BANCO CENTROAMERICANO DE INTEGRACION ECONOMICA
b. BID: BANCO INTERAMERICANO DE DESARROLLO
c. BIRF: BANCO INTERNACIONAL DE RECONSTRUCCION Y FOMENTO
d. BG: BANCO DE GUATEMALA
e. INFOM
f. MINISTERIO DE FINANZAS

(2) Interest rate

There are 3 types of interest rate for procuring money from the banks above mentioned. They are:

a. Normal: 8-9% per year
b. Low: 3-4% per year
c. Variable: Variable in International Banks (as of Feb. 1991)

The low interest rate, however, can only be applied for social matters. Additionally, it takes much time to reach a loan agreement with International Banks, because of the long procedure for approving the project shown in table I-3-7.

(3) Repayment period

In relation to the repayment period, it fluctuates according to the case. Usually, it is from 15 to 30 in case of a low interest and International Banks, and 10

to 15 years for a normal interest. Grace period about 3 to 10 years would be applied for low interest case if necessary. Also, annual repayment and semi-annual repayment have been applied to the municipality.

The results of the municipal financing are shown in table I-3-8.

Table I-3-7 Procedure for project approval

1. To fill in application form of bank and send it to the bank

   - To prepare general description of the project

2. The banks analyzes it and sends analysis terms to Municipality

3. The Municipality reports analysis terms to the bank

4. The bank issues a report

   - To clear any doubts and establish guide lines

   The bank exercises economical evaluation

   - To show terms of loan and payment capability

5. The bank authorizes the operation and establishes conditions

6. Procedure in the Municipality

   a. Declaration of a high priority project by the Municipality

   b. Requesting SEGEPLAN to establish it as a national development project

   c. Decision of applying for foreign financing by Ministry of Finance

7. Formalization of the operation

8. Start of project

TABLE I-3-8 FINANCING CONDITIONS OF THE MUNICIPALITY

Bank	Date of Contract	Borrowing Amount (Q. 1000)	Interest Rate (%/y)	Commission (%/y)	Repayment Period (y)	Grade Period (y)	Used for
BID	30/4/83	5,500	1.25	0.75	30	1	Sewage
BID	31/3/88	298,199	2.00	0.00	30	-	Potable water
Banco de Guatemala	9/4/80	6,000	5.00	0.25	15	-	-
Banco de * Guatemala	11/5/83	3,000	8.00	0.25	15	-	-
BCIE	30/11/76	2,720	8.00	0.20	15	4	-

Note: * indicates that add-on method was applied for refund of principal.
Straight-line method was applied for others.

Source: Finance Direction of Municipality

3. Institutional Development of DLPM

Contents

3. Institutional Development of DLPM

The Institutional Development of the DLPM includes three chapters: No. 1, Organizational and Institutional Development of the DLPM; No. 2, Concessions to the Private Collectors; and No. 3, Financing.

3.1 Organizational and Institutional Development

The service of public cleansing is officially the responsibility of the Municipality. In the case of the City of Guatemala, this responsibility comes under the sphere of action of the Department of Public cleansing, a subdivision of the Direction of Public Services, which partially operates the collection and, in full, the cleansing of public streets and final disposition of solid waste. The other exclusive characteristic of the City of Guatemala, which differs from other Latin American capital cities, is that it has Private Collectors who are in charge of most of the collection of domestic solid waste. This private service should be kept and improved, as without its decisive cooperation the Municipality would have neither the operative nor the financial capacity to provide the service, at least in a short and medium term.

Therefore, the Organizational and Institutional Development of the DLPM contemplates basically to maintain this much needed duality of the municipal and private collection service.

3.1.1 Recommended Institutional organization

Two aspects related to the Institutional Organization were studied consecutively:

No. 1 Institutional Administration of solid waste in the Metropolitan Area of the City of Guatemala.

No. 2 After defining the former, the alternatives for the Institutional Organization of the DLPM were studied.

(1) Administration of solid waste in the Metropolitan Area

Table 1-3-1 the study of this aspect is synthesized.

Alternatives:

1) All the operations of the public cleansing service (sweeping, collection, transportation, and final disposal) are completely executed by direct administration of the Municipality of Guatemala.
2) Dual Municipal and Private Service, similar to the current service, but characterized by a higher efficiency. Independent administrative, operational, and financial systems, but with municipal planning, supervision, and control.
3) Mixed Municipal Company, forming a new autonomous municipal company, with municipal and private participation, which could include the current private collectors.

Criteria:

The criteria used to evaluate and select the most appropriate alternative was the following:

1) Planning function
2) Coverage increase
3) Continuity of service
4) Administration
5) Financing
6) Establishment and collection of fees
7) Political influence
8) Public opinion
9) Social cost

TABLE

Alternatives for the Institutional Administration of the Solid Waste Management			
	Alternative 1	Alternative 2	Alternative 3
Characteristics	All the operations of the public cleansing service (sweeping, collection, transportation, final disposal) are executed by the direct administration of Municipality.	Mixed Municipal and private service, similar to current service but with more efficient characteristics than the current one. Administrative, operational, Commercial and financial independence between the two services, but with municipal supervision and control.	Mixed enterprise, forming a new municipal enterprise; with municipal and private participation, which could include the participation of the current private collectors.
1. Planning system	Municipal	Municipal, but with the private group's autonomy to plan its operating, commercial, administrative and financial parts.	Autonomy as a para-municipal company.
2. Service coverage	Due to administrative rigidity it is difficult to quickly ? the extension of the coverage.	Fluidity in the private sector in response to the expansion of the coverage.	Theoretically there would be a quick response to expand the coverage, but there is no experience.
3. Continuity of the service	Very exposed; to labor disputes (big disadvantage)	In the past the private collection has never stopped (big advantage)	Very exposed its labor disputes
4. Administration	With tendency to bureaucracy	Possibility of bureaucratization in the municipality part. None in the private sector.	Some possibility of bureaucratization.
5. Financing	The ordinary tax income and the ordinary transference (8% of national budget) received by the Municipality are limited. There would be a need to charge new fees and taxes.	Municipal service: requires of an increase of the municipal budget. Private service financed by direct charge of fees to the customers, a commercial system which has worked without problem until now.	In theory it would be same as Empagua financing; although the company should approve and establish the tariffs which are not charged actually.
6. Establishment and charge of tariff	Difficult decision	Private collectors do not have problems. It currently is working very well.	Difficult decision
7. Political influence	Totally dangerous (disadvantage)	Partially dangerous only on the municipal side	Dangerous
8. Opinion of the public	Unfavorable toward the Municipal services	Good toward the private collectors	Unknown
9. Social cost	Great	No	Great
Comprehensive Evaluation	C	A	C

A: BUENA B: MODERADA C: BAJA

Evaluation:

The conclusion shows that in the country's current socioeconomic situation and socioeconomic situation foreseen for the decade, the most recommendable alternative is Alternative 2, Municipal and Private Dual Service.

(2) Institutional Organization of the DLPM

After having defined the Municipal and Private Dual Service as the most recommendable alternative for the management of solid waste in the Metropolitan Area, the organization and institutional levels of this Municipal Organism were evaluated. In Table I-3-2 the analysis of the alternatives is synthesized.

Table I-3-2 Organization and Level of DLPM

Concept	Alternative 1 Department level at present organization	Altrenative 2 Direction of public cleansing	Alternative 3 Public cleansing municipal enterprise	A: Very good B: Moderate C: Low
1) Finance	B	A	C	
2) Autonomy	B	B	A	
3) Administration	C	B	A	
4) Relation with priv. collectors	C	A	C	
5) Image	B	A	B	
Evaluation	B - Constraints in the autonomy, administration and relation with priv. collectors. - Moderate possibilities of financing.	A - Very good image, financing, and relation with private collectors - Moderate autonomy and administration	B - Very good possibilities of autonomy and administration - Moderate image - Obstacles with financing in the decade and unfavourable relation with priv. collectors	

ALTERNATIVES:

1) Department, at a similar level to that presently occupied by DLPM in the municipality of Guatemala City.

2) Public Sanitation Department, elevating the level within the municipal organization.

3) Public Sanitation Corporation, of similar characteristics to the present EMPAGUA.

CRITERIA:

1) Financing
2) Autonomy
3) Administration
4) Relationship with Private Collectors
5) Prestige within the Municipality, with other official and private institutions, and with the public

EVALUATION:

Alternative 2, to elevate the administration, is that selected to adequately respond to the situation in regard to financing and relationship with private collectors.

(3) Intermunicipal Organization in Solid Waste Handling

1) According to the legal dispositions in effect in the country, the Municipalities of the City of Guatemala, Mixco, Villa Nueva, Chinautla, Santa Catarina Pinula, and Villa Canales are responsible for the public cleansing service in their respective jurisdictions. They could confer and/or contract the operations, but the responsibility for

providing the services cannot be delegated.

2) Consequently, the sweeping and collection services are rendered by each municipality within the area of its jurisdiction.

3) Having selected the dual system for collection service (municipal/private), the granting of concessions will be done by the respective municipality in whose jurisdiction the concession will take place. Nevertheless, the bases and conditions for the granting of concessions will be followed and observed by all the Municipalities in the Metropolitan Area.

4) Final disposal (El Trebol and Las Guacamayas landfill)

   a. The operation and administration will be in charge of the DLP of the Municipality of the City of Guatemala.

   b. The planning and financing will be regulated, supervised and coordinated by the Metropolitan solid Waste Committee, CMDS (Comite Metropolitano de Desechos Solidos").

5) "Metropolitan Solid Waste Committee", CMDS

   a. Will have as a regular objective the regulation, supervision, and coordination of the planning and financing of the metropolitan sanitary landfills; the coordination and solution of the cases of jurisdiction conflicts arising in the collection services; the sole application of the Bases and Conditions for the granting of concessions to the Private Collectors by all the Municipalities; any other

TABLA

ORGANIZACION INTERMUNICIPAL EN EL MANEJO DE LOS DESECHOS SOLIDOS EN EL AREA METROPOLITANA DE LA CIUDAD DE GUATEMALA

FUNCION	RESPONSABLE
1. RESPONSABILIDAD DE LA LIMPIEZA PUBLICA	CADA UNA DE LAS MUNICIPALIDADES DE GUATEMALA, MIXCO VILLA NUEVA, CHINAUTLA, STA. CATARINA PINULA Y VILLA CANALES EN EL AREA DE SU JURISDICCION
2. RECOLECCION Y BARRIDO	CADA MUNICIPALIDAD EN EL AREA DE SU JURISDICCION
3. ADJUDICACION DE CONCESIONES A A RECOLECTORES PRIVADOS	CADA MUNICIPALIDAD EN EL AREA DE SU RESPECTIVA JURISDICCION
4. DISPOSICION FINAL EN LOS RELLENOS DE "EL TREBOL" Y "LAS GUACAMAYAS":	
4.1 PLANIFICACION Y FINANCIACION	SERAN REGULADOS, SUPERVISADOS Y COORDINADOS POR EL "COMITE METROPOLITANO DE DESECHOS SOLIDOS"
4.2 OPERACION Y ADMINISTRACION	DLP DE LA MUNICIPALIDAD DE LA CIUDAD DE GUATEMALA

matter related to the management of solid waste which requires the inter-municipal coordination of the Committee.

b. The Committee will have a permanent status and it will be initially authorized by agreement of each of the corresponding Municipal Councils.

c. It will be presided by the delegate of the Municipality of the City of Guatemala, and it will be comprised by a delegate from each of the Municipalities of the Metropolitan Area.

d. Its functions will be basically of consultation and will serve so that the corresponding Municipalities can make the convenient decisions.

e. The Committee will meet as many times as it considers necessary, but at least twice a year.

f. Each Municipal Corporation will guarantee the existence of the Committee and will see that it complies with its objectives and attributions.

g. The delegates of each of the Municipalities of the Metropolitan Area will be officially designated by the corresponding Municipal Corporations and will thus obtain a true representation at an institutional level and the support of the superior authority.

h. The Committee will see to the adequate fulfillment of the norms and policies established for the collection, sweeping, transport, and final disposal of the solid waste in each and every one of the Municipalities in the Metropolitan area.

3.1.2 Proposed Organizational Structure

As indicated above, the recommended alternative is to organize, starting in 1992, the Direction of Public Cleansing, DLP, a municipal office which will be responsible for the management of solid waste in the City of Guatemala, and will also coordinate the management of solid waste in the metropolitan Area with the involved Municipalities.

(1) General

The proposed organizational structure is shown in the Organizational chart in Figure I-3-1. This elected alternative will provide the greatest perspectives for the improvement of the management of solid waste as the following criteria was considered:

1) It includes the formal and coordinated participation of Private Collectors in the Public Cleansing System, thus avoiding social conflicts.

2) It incorporates the Planning and Evaluation systems essential for decision making in the Direction of Public Cleansing.

3) It promotes, in a permanent and continuous way, community education and participation to help the management of solid waste. Nevertheless, at the same time it reinforces the surveillance process and the compliance of the respective laws and regulations.

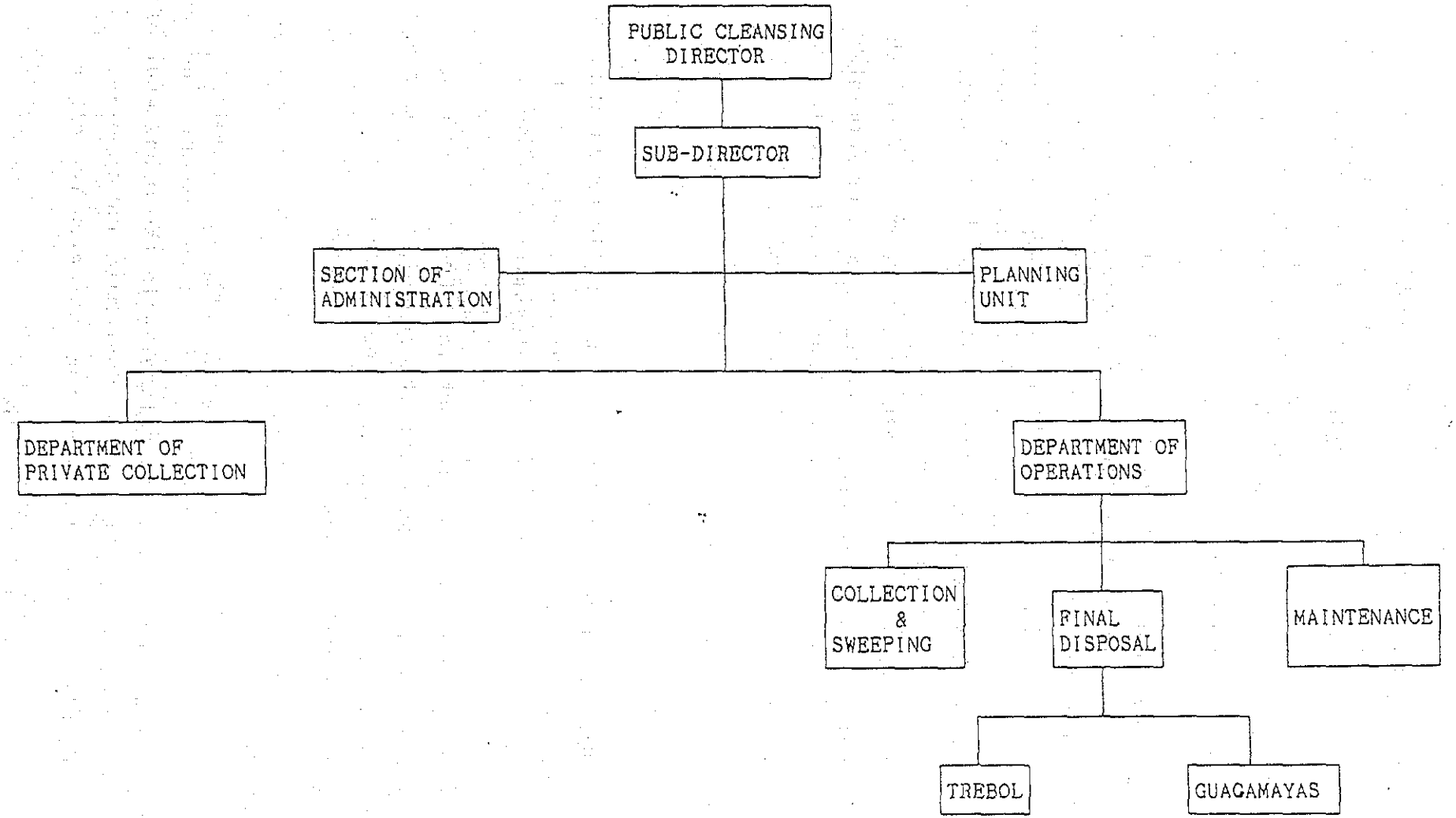


FIG. ORGANIZATIONAL CHART FOR DIRECTION OF PUBLIC CLEANSING, DLP

4) It improves the operational efficiency of the municipal cleansing service without increasing personnel, except in key positions, and at the same time it also does not cause social problems as there are no dismissals and no reduction of personnel. This, furthermore, includes training of human resources.

5) Improvement of the relations and coordination of the DLP with the following Municipal offices: municipal Court, Direction of Public Services, Legal Administration, School of Municipal training, Unit of Institutional Development, Education and Culture, Markets and Execution of Works. The new proposed organizational structure of the DLP has the Direction which includes the Sub-Direction, the Unit of Planning and Evaluation and 3 departments: Private Collection, operations, and Administration.

(2) Direction of Public Cleansing

Definition:

The Direction and Sub-Direction of Public Cleansing plans, organizes, directs, coordinates, controls and operates the lending of public cleansing services in the City of Guatemala, efficiently administrating its function in benefit of the public. Public Cleansing service is understood to be the sweeping of streets and public areas, collection, transport, treatment and final disposal of solid waste.

Functions:

- To direct, plan, organize, coordinate, execute and control the activities related with the management of solid waste in the City of Guatemala and to plan, organize, and coordinate, together with the other

municipalities the management of solid waste in the Metropolitan Area.

- To dictate and ensure that the laws and regulations related to the lending of public cleansing services are complied with.

- To coordinate the surveillance and fulfillment of laws and regulations on the management of solid waste with other associated entities such as the Ministry of Public Health and Social Assistance, CONAMA, INFOM, and municipalities of the Metropolitan Area of Guatemala.

- It coordinates activities with other dependencies within the Municipal Government.

Personnel:

- 1 Director (new position)
- 1 Sub-Director
- 2 Secretaries

TOTAL: 4 persons

(3) Planning and Evaluation Unit

Definition:

It comprises all the activities directed toward the formulation, evaluation and control of the plans of the Direction of Public Cleansing. These are understood to be the definition of objectives, goals, and future activities; and resources with which to obtain them.

Functions:

- To prepare short, medium and long-term plans.

- To evaluate the costs and efficiency of all the operations of DLP.

- To prepare and implement the respective budget program.

- To gather and process all the statistical information of DLP.

- To establish a data processing system which allows the use of the basic information in making DLP decisions and of the various programs under their responsibility.

- To provide technical assistance to the community in relation to the management of solid waste.

- To maintain the control of programmed activities, verifying the performance achieved, the causes for the variation, and the corrective measures to be applied.

- To prepare and carry out the training programs of DLP personnel.

- To prepare the necessary projects for the improvement, updating and expansion of legal rules and dispositions with reference to the management of solid waste.

- To promote massive education and communitary participation through a video program, public cleansing campaigns, recuperation and re-cycling programs, and the correct use of containers in different areas. To carry out these activities in different populated areas, such as: marginal areas, markets, isolated areas, schools, private

collectors, DLP itself, etc.

- To register complaints from the public, and direct them to the respective Department to be seen to.

Personnel:

- 1 Sanitary engineer, Head of Unit (new position)
- 1 Economist
- 1 Statistician
- 1 Social Worker or Educator
- 1 Secretary

  TOTAL: 5 persons

(4) Department of Private Collection

Definition:

It is comprised of all the activities destined to organize, supervise, control and coordinate private collection in order to improve and expand the dual system of collection in all of the metropolitan area.

Functions:

- To strengthen the dual System of Collection.

- To supervise and control private collection.

- To coordinate with the private collectors to improve the quality of the service and to increase coverage.

- To study and organize the collection zones with the objective of granting them.

- To develop the bases and procedures for the grants.

- To assign and contract grants.

- To promote private collectors, by means of technical counseling training courses, supervising of illegal and clandestine competition.

- To give surveillance for the fulfillment of the contracts and cancel and/or sanction in the cases of lack of fulfillment and infractions.

- To give surveillance so that all solid home waste, generated within the concession zones, be collected by the private concessionaire who provides the service.

Personnel:

- 1 Administrator, Head of the Department
- 2 Assistants
- 5 Guards (To be increased gradually in function of the granted zones)
- 1 Secretary

  TOTAL: 9 persons

(5) Operations Department (Headquarters)

Definition:

It comprises the elements, resources and activities that are developed to administer the elaboration and execution of collection projects, sweeping, storage, transport, treatment and final disposition of solid wastes in a direct manner or by means of contracts, and also to operate and maintain the equipment and installations destined to the carrying out of public cleansing services.

Sections:

The Department of Operations has three Sections:

- Collecting and Sweeping
- Final disposition controlled landfill "El Trebol" and the sanitary landfill of "Las Guacamayas"
- Maintenance

Functions:

- To direct, supervise, control, and evaluate the activities that the sections in its charge carries out.

- To establish the DLP services that the DLP should give the population, especially in marginal areas, in satisfactory conditions as to quality, frequency, continuity, coverage, and cost.

- To achieve that the projects and works be developed according to the plans and programs of the DLP and to the needs of the community, in what respects to quality, operation terms and costs.

- To maintain the necessary conditions so that the installations and equipment can be operated in an adequate and efficient manner and so that they will continue expanding their durability to its full capacity at the least possible cost.

- To gather information on the sweeping and collection services, transportation and final disposal, and each one of their components, and to transmit it to the Planning Unit for its processing and evaluation.

- To promote the recuperation and sanitary recycling of the elements constituted by solid wastes.

- To see to the fulfillment of the regulations of solid wastes through the sections under its responsibility.

Personnel:

- 1 Administrator, Head of the Department
- 1 Secretary

  TOTAL: 2 persons

1) Collection and Sweeping Section (Department)

   Definition:

   It includes all of the activities that should be developed in order to operate the sweeping of public areas services, and also the collection and transportation of solid waste on the part that is under the responsibility of the DLPM.

   Functions:

   - To extend and optimize the service of sweeping paved streets by means of manual and mechanical methods.

   - To optimize the cleaning of parks and public streets through the "pica-pollo" method.

   - To increase the collection of solid waste in assigned areas, especially in marginal areas, employing the following procedures: "bell" system, container system, station system, convoy system and other procedures that are considered applicable.

   - To collect the solid wastes which come from sweeping public streets.

- To transport all of the solid waste collected to the operational landfills.

- To increase the efficiency of the operative systems under its charge, adjusting to the adopted norms of quality, frequency and continuity of the services offered.

- To prepare all of the information about characteristics, personnel, procedures, and control used in the sweeping, collection and transportation services and transmit them to the Head of Operations.

- To inform the Maintenance Section of the way the equipment operates.

- To inform the head of Operations as to the modifications and diagramming of the collection routes.

- To see to the fulfillment of the existing legal norms as to sweeping and collecting by the public.

Personnel:

- 1 Head of Collection and Sweeping Section
- 1 Secretary
- 8 Technicians
- 55 Equipment Operators
- 15 Guards
- 70 Qualified Workers
- 82 Non-qualified collection workers
- 333 Non-qualified sweeping workers

  TOTAL: 565 persons

2) Final Disposal Section (Department)

Definition:

It includes all of the activities that should be developed to operate the final disposal installations of solid waste. Specifically, the controlled landfill of "El Trebol" and the sanitary landfill of "Las Guacamayas".

Functions:

- To carry out the final disposal projects at the "El Trebol" and "Las Guacamayas" landfills.

- To maintain control of the places where the final disposal is carried out.

- To give technical assistance to the possible mini-landfills that will be carried out in the isolated areas during the decade.

- To prepare, manage, and process the necessary information of the landfill operations in order to know the required indicators so as to improve the efficiency of the final disposal and to transmit them to the Head of Operations.

- To control the operation and functioning of the equipment and to inform the Maintenance Section.

- To concert with the scavengers of "El Trebol", the coordinated operational process of the landfills to improve its efficiency and quality, and it will give sanitary conditions and required security to this type of controlled landfills.

Personnel:

- 1 Head of Section of final disposition
- 1 Secretary
- 7 Technicians and Operators
- 11 Qualified Workers
- 23 Non-qualified Workers

TOTAL: 43 persons

Starting in 1993, when the "Las Guacamayas" landfill operation is initiated, the following personnel should be added:

- 3 Equipment operators
- 3 Qualified Workers

3) Maintenance Section

Definition:

Its task is the maintenance of all DLPM equipment with which it carries out the sweeping of streets, collection and transporting, and the final disposal of solid wastes.

Functions:

- To carry out the preventive maintenance and minor repairs of DLP vehicles and equipment.

- To supervise and control major and specialized repairs which have been contracted with private workshops.

- To manage and process information to establish indicators with the goals of facilitating the renovation parts in "stock", the purchase of new vehicles and preparation of the annual budge.

- To repair and maintain minor equipment of street cleaning and containers.

Personnel:

- 1 Head of Section
- 3 Mechanics
- 1 Electrical Mechanic
- 4 Mechanical Assistants
- 2 Welders
- 2 Body workers - painters
- 3 Tire fixers (technicians)
- 2 Greasers
- 29 Maintenance Workers

  TOTAL: 43 persons

(6) Administration Department

Functions:

Management to Accounting Section

- To supervise and evaluate the head of section
- To inform the Head of Section of main projects
- To identify the problems and give orders for their solution
- To confirm the execution of the budget according to schedule

Management of General Affairs Section

- To supervise and evaluate the Head of Section
- To inform the Head of Section of main projects
- To identify the problems and give orders for their solution
- To prepare the inventory control according to the budget.

Others

- To evaluate the data processed by the Sections under his responsibility and inform the Director of the DLP.

- To improve the relations with other departments.

Personnel:

- 1 Chief
- 1 Secretary
  TOTAL: 2 persons

1) Accounting Section

Functions:

a. Execution of budget

Purchase of goods

- To prepare a preliminary monthly expenditure plan for the entire year, based on the annual budget for said year after having negotiated with all the sections.

- To obtain from each section the detailed purchase lists to be executed the following month.

- To prepare the expenditure schedule and decide which will be the exact purchase lists.

- To inform the Department of Finance of the Municipality which will be the total amount to be paid the following month.

- To prepare the payment sheets.

- To classify the payment sheets and register the information in the accounting books.

- To pay salaries.

- To register each worker's extra hours.

- To prepare the monthly salary sheets.

b. Preparation of documents submitted to the Head of the Department.

Personnel:

- 1 Head of department
- 1 Assistant
  TOTAL: 2 persons

2) Section of General Affairs

Functions:

a. Inventory control

- Fuel and spare parts
- Other accessories and supplies

b. Control of the labor situation of the personnel.

- Attendance control
- Performance control
- Motivation and increase of morale among workers

c. Medical exam

- To control the physical situation of the workers
- To carry out a yearly medical check-up

d. Management of machinery and equipment

- To keep books of all the assets
- To check the condition of the equipment

Personnel:

- 1 Head of section
- 2 workers
  One in charge of functions a and b.
  One in charge of functions b and c.
  TOTAL: 3 persons

(7) Indicators

The principal indicators to be evaluated are:

1) Generation of solid waste Kg/Hab/day.

2) Coverage: % of population served with collection in respect to the total population.

3) Productivity: No. of inhabitants served by each employee of DLP.

4) Quality: % of number of satisfied surveyed users with respect to the total number of surveyed users.

5) Cost

- Manual and mechanical sweeping ($/Ton sweeping)
- Collection ($/Ton collected)
- Final disposition ($/Ton filled-in)

6) Operation

- Tons of collected garbage per month
- Tons of garbage disposed of at "El Trebol" and "Las Guacamayas" per month

7) Yield of platform scale: No. of weigh-ins per day

8) Frequency of claims or complaints: Total number per month/served population

9) Personnel:

- Turn-over: % of dismissals per year in relation to the total number of employees.
- Absenteeism: % of days absent in relation to the total number of working days of all of the personnel

10) Private Collectors

- Registration of private collectors
- Tons collected per day
- Quality: % of number of satisfied surveyed users in respect to the total of surveyed users

3.1.3 Communitary Participation

The state of cleanliness of the city is in direct relation to the aspirations of the inhabitants and to their "motivation" to reach this condition. If the inhabitants do not feel the need to keep their city clean, the DLP will have to spend a lot of money and efforts in the cleansing of the city.

In fact, the condition of cleansing increases and its cost decreases when there is participation of the community.

Social communication is a means of obtaining the participation of the community in the adequate management of solid waste and, therefore, a program is outlined which comprises:

1. Talks with the residents
2. Communitary motivation
3. Effective presentation of DLP to the public

(1) Talks with the Population

1) Awareness on the part of the neighbors as to the benefits of sanitary and environmental order that could be obtained (the JICA video could be of help for this job).

2) Without information, the community does not know how it can collaborate (the JICA video can help).

3) The rules and municipal demands should respond to the social-economic reality that is lived in Guatemala.

4) Try to erase the concept that the Municipality should supply all of the communities' necessities, without the collaboration from the residents.

5) It must be kept in mind that some of the inhabitants especially in marginal areas, do not value cleansing jobs, due to their subjective nature.

6) The efficiency of DLP service is fundamental. The community's participation should be requested only after it has been offered the service at the level that they need.

7) The continuity and regularity of the service, attention to complaints, and the divulgation of the services from part of DLP's image.

8) Simple written presentations with nice visual illustrations will help this dialogue process.

(2) Motivation of the Community

Efforts for mass communication should consider the following elements:

1) The message, which is the information on management of solid waste which is desired to be transmitted.

2) The means or instrument of transmission

- The video prepared by JICA will be an appropriate instrument.
- Radio (transmissions) will be another appropriate instrument. Almost all of the marginated homes have a radio.
- Written press communications always has been a large instrument on urban cleaning news.
- Talks and conferences also are an efficient help.
- School cleaning contests and campaigns.
- Service Clubs.
- Public opinion surveys, made known but in a dosified manner
- The support of the APT program will be an important vehicle.

3) The addressee is he from whom the effectiveness of the message is obtained.

- Residents and housewives, especially in marginal areas
- School students

- The DLP cleaning workers, and private collection workers
- Especially selected groups: Workers at markets, street vendors, etc.

3.1.4 Personnel Training

With the object of facilitating the implementation process of DLP, improving the ability of its workers and, furthermore, preparing them for the new jobs that will be implanted in the new cleansing entity, a Training Program that reaches the different levels of personnel should be developed during the decade.

(1) Justification

The new DLP demands qualified personnel for the managerial and operative levels. As the DLP will use the present DLPM personnel and other personnel that will be transferred from other municipal branches, and only exceptionally will some new personnel will be contracted, the program of personnel training is widely justified, and the same should be continuous, realistic and objective.

(2) Levels of Training

Proposed training should be carried out on three levels:

1) Managerial - for the Director, Sub-Director, Heads of Department and Heads of Section

2) Medium - for the responsible employees in charge of Control, Supervision and support activities. It would be directed to the training related to the control collection system, sweeping of streets, maintenance of equipment, and final disposal in sanitary landfill operations, and of communitary

and administrative educational activities.

3) Operational - for drivers, mechanics, equipment operators, and workers in general. This training should be strictly practical with the purpose of finding better efficiency in the routine operations of the sweeping of streets, collection, transportation and final disposal.

(3) Development of the Program

1) For the training at general level, it is mainly suggested that there be training in service in similar foreign entities for periods of approximately one month. Several industrialized countries and some countries of Latin America can offer this kind of training. They could also participate in short courses out of the country, such as those that OPS and other international organizations periodically prepare. The goal would be to annually send one or two officials in this level, starting in 1991.

2) For the medium level, the strategy is the development of short courses in the country with the support and sponsorship of international organizations such as OPS, bilateral organisms as the course on preventive maintenance which JICA has just carried out with the Municipality of Guatemala, other national public and private organisms, and universities. A desirable goal is to train 15 persons per year, starting in 1991. They should be short courses, of practical character and backed with manual instructional guides that can serve as a permanent reference.

3) The training program for the operational level will be given basically through sessions in the work

areas and workshops. These sessions can be backed with audio-visual resources, be they films or video cassettes. New methods for working more efficiently will be analyzed in them. The goal is to prepare two activities per year, for 80 persons, starting in 1992.

4) Training Costs

Budget resources have not been considered specifically at the DLP for training, because International Organisms, Bilateral Agencies of cooperation, and other national entities can provide scholarships and give donations to sponsor these training activities.

The municipal contribution will be above all, the one that corresponds to its current capacity as to human resources and physical infrastructure.

The carrying out of the training programs will be under the responsibility of the Planning Unit of DLP.

3.1.5 Institutional Development Implementation

Summing it up, the basic criteria to achieve the implementation of institutional development and thus the master plan are the following:

(1) The sanitary and operational improvement of the final disposal and the extension of the collection service in the marginal areas will require higher budget resources for the public cleansing service, which include higher operational costs for materials and financial cost for investments, and not through an increase in personnel expenditures, as the number of personnel will not be changed. The criterion is that within the current

organizational structure of the Municipality, an upgrade of the current department will give it better opportunities to discuss and negotiate this budget increment, which is reasonably limited.

(2) The name which the municipal dependency in charge of solid waste management will be given is not what matters the most.

What really does matter is the internal reorganization of this office, due to the problems identified in the institutional diagnosis carried out during the First Field Survey in July-August 1990. The criterion for this change and reorganization of the Cleansing Department, proposed by JST, are based on:

- Formal and coordinated participation of the private collectors
- Essential incorporation of the Planning and evaluation system for decision making
- Promotion of community education and participation
- Improvement of operational performance to satisfy the collection demand in marginal areas and lessen the number of open clandestine dumps (500)
- Start of a preventive maintenance program
- Need for a personnel training program
- Bettering of the present sanitary conditions of "El Trebol".

(3) The common denominator to achieve what has been proposed is the institutional, financial and political backing of the Municipal Company to the public cleansing service, without which very little or nothing will be attained of what is mentioned in (1) and (2), and therefore, in the implementation of the Master Plan.

3.2 Concession to Private Collectors

Having selected the dual Collection System, Municipal and Private, it is necessary to give the guidelines so that this private collection can operate efficiently under the supervision and control of the DLP. The concession process is the chosen road and it basically consists in formalizing the present concessions to the private collectors. This process of concession granting should be a gradual process due to the conditions and factors analyzed in the First Field Study.

Many years ago the Municipality accepted that the private collectors lend this service in several of the city's areas, thus practically establishing a concession system. This was ratified and approved by the Environment Cleansing and Sanitation Regulation for the Municipality of Guatemala, in effect since April 16, 1982. What was resolved in this Regulation has not been totally implemented, making it necessary to formalize the gradual granting of concessions to the private collectors.

3.2.1 Concession Process

(1) Zoning

1) Keep the jurisdiction of the current 22 zones in the City of Guatemala.

2) Of these 22 zones, total or partial concessions can be granted in 20 zones during this decade. Zones 24 and 25 are excluded as they are rural areas. The zones which correspond to the Municipalities of Mixco, Villa Nueva, Chinautla y Villa Canales should also be included.

3) The zone corresponding to Sta. Catarina Pinula will be treated as an isolated area, with a specific

approach.

4) The City of Mixco, with a high population, could be even subdivided into 3 zones for concession purposes.

5) Also, as an alternative, taking into consideration that zones 7 and 18 have a high population rate, it is recommendable that they be subdivided into 2 subzones each (7A and 7B; 18A and 18B).

6) To sum it up, taking the foregoing into account, zoning for concession purposes will comprise: 20 zones in the City of Guatemala, Mixco and Chinautla. In total 22 zones. Private collection will not be possible in Villa Nueva and in Villa Canales.

7) Nevertheless, the foregoing zoning is theoretical and in practice should be adjusted to local conditions and characteristics and to jurisdictional, topographic, and access problems that may appear. Therefore, for example, the following cases may occur among others:

   a. Zones which are partially granted.
   b. Residential areas, within the zones, which merit being independently granted.
   c. Isolated areas that could be granted by concession to the private collectors.
   d. Sectors in a zone which due to topographical reasons or of easy access, could be granted in concession to the adjacent zones, even when jurisdictionally they belong to another municipality.

8) Therefore, zoning cannot be rigid and special cases should be dealt with and resolved by the Department of Private Collection of DLP, with the support of the Direction's Planning Unit.

The solution of the intermunicipal jurisdictional cases will count with the support of CMDS (Metropolitan Solid Waste Committee), whose formation is proposed in this study.

9) In table I-3-4 an exercise is shown in which are indicated the possible concession zones, the outlined population for the year 1995, the estimated amount of solid waste generated in each zone in 1995, and the loading capacity required each workday to collect the total amount of solid waste generated in the areas of easy collection. Of course, this exercise would represent the best private collection alternative.

10) In tables I-3-5 and I-3-6, the exercises of financial simulation for the formalization of concessions in the zones during this decade are shown. In these exercises the use of most of the existing private collection vehicles has been considered; an additional 20% stand-by load capacity can be anticipated (due to the age of these trucks); the high, medium, and low-income level relations obtained in the first field study are used; and average tariffs were simulated for each of the levels in Cases A and B.

Tabla I-3-4

Zopnas Concesionables a recolectores Privados y Capacidad de Carga requerida. (Decada 1991-2000)

Zonas	(1) Pobl. 1995 (1000)	(2) Pobl. Con Recolección Privada. (1000)	(2) % --- (1)	Cantidad a ser Recolectada (m^3 -Dia Lab)
Guatemala Z 1	46.20	46.20	100	131.90
Guatemala Z 2	27.80	27.80	100	79.40
Guatemala Z 3	48.40	48.40	100	138.20
Guatemala Z 4	4.10	4.10	100	11.70
Guatemala Z 5	84.60	84.60	100	241.50
Guatemala Z 6	94.40	94.40	100	269.50
Guatemala Z 7	204.80	204.80	100	584.70
Guatemala Z 8	19.90	19.90	100	56.80
Guatemala Z 9	3.50	3.50	100	10.00
Guatemala Z 10	14.80	14.80	100	42.30
Guatemala Z 11	75.20	75.20	100	214.70
Guatemala Z 12	55.60	55.60	100	158.70
Guatemala Z 13	39.90	39.90	100	113.90
Guatemala Z 14	28.90	28.90	100	82.50
Guatemala Z 15	28.70	28.70	100	81.90
Guatemala Z 16	23.00	12.30	53	35.10
Guatemala Z 17	30.60	19.50	64	55.70
Guatemala Z 18	246.70	142.90	60	408.00
Guatemala Z 19	38.50	20.30	53	58.00
Guatemala Z 21	74.80	54.40	73	155.30
Guatemala Z 24	9.90	--	--	--
Guatemala Z 25	8.30	--	--	--
Mixco	424.20	151.60	36	432.80
Villa Nueva	62.50	--	--	--
Villa Canales	28.30	--	--	--
Sta. C. Pinula	22.30	--	--	--
Chinautia	43.30	43.30	100	123.60
Total	1789.30	1221.10		3486.20

NOTA: Producción per capita-dia iaborable: 0.708 kgr:
Densidad: 0.248

TABLE I-3-5. FINANCIAL EXICISE FOR PRIVATE COLLECTION BY CONCESSIONS (CASE A)

ZONE NAME	COLLECTION (M^3/wd)	NUMBER OF TRUCKS	INCOME COMP. H : M : L	AVERAGE TARIFF	PROFIT RATE
ZONA 1	131.8	11	5 58 38	4.32	31.54
ZONA 2	79.3	7	0 73 28	4.63	32.28
ZONA 3	138.1	11	0 63 38	4.13	31.50
ZONA 4	11.6	1	0 93 8	5.63	45.85
ZONA 5	241.6	19	0 48 53	3.38	17.31
ZONA 6	269.6	21	0 53 48	3.63	23.75
ZONA 7	584.7	45	0 73 28	4.63	40.95
ZONA 8	56.7	5	0 53 48	3.63	13.63
ZONA 9	10.0	1	65 35 0	8.60	58.62
ZONA 10	42.4	4	85 15 0	9.40	64.36
ZONA 11	214.6	17	10 90 0	6.40	56.08
ZONA 12	158.8	13	25 63 13	6.38	54.44
ZONA 13	114.0	9	30 53 18	6.32	55.72
ZONA 14	82.6	7	85 13 3	9.27	67.57
ZONA 15	81.9	7	80 13 8	8.82	65.65
ZONA 16	35.2	3	0 53 48	3.63	16.47
ZONA 17	55.6	5	0 63 38	4.13	22.68
ZONA 18	407.9	32	0 58 43	3.88	28.16
ZONA 19	57.8	5	0 53 48	3.63	15.38
ZONA 21	155.5	12	0 73 28	4.63	40.79
ZONA 24	0.0	1	0 53 48	0.00	0.00
ZONA 25	0.0	1	0 53 48	0.00	0.00
Mixco	432.9	34	5 38 58	3.32	16.17
Villa N	0.0	1	0 53 48	0.00	0.00
Villa C	0.0	1	0 53 48	0.00	0.00
SC.Pinu	0.0	1	0 78 23	0.00	0.00
Chinaut	123.7	10	0 43 58	3.13	8.18

FOOTNOTE :

1. COLLECTION
   - (1) COLLECTION VEHICLE
     - CAPACITY 15.0 m^3
     - LOAD FACTOR 70.0 %
     - RESERVE 20.0 %
   - (2) NUMBER OF TRIPS 1.5 /wd
   - (3) NUMBER OF HELPERS 4.0 persons/vehicle
   - (4) DENSITY 0.248
2. FINANCE
   - (1) TARIFF
     - HIGH INNCOME 10.0 Q/month,house
     - MIDDLE INCOME 6.0 Q/month,house
     - LOW INCOME 1.0 Q/month,house
   - (2) PERSONNEL COST
     - OWNER 600.0 Q/month,person
     - HELPER 250.0 Q/month,person
   - (3) FUEL&MAINTE.COST 500.0 Q/month,vehicle
   - (4) OTHER COST (2) * 10.0 %

TABLE I-3-6. FINANCIAL EXICISE FOR PRIVATE COLLECTION BY CONCESSIONS (CASE B)

ZONE NAME	COLLECTION (M^3/wd)	NUMBER OF TRUCKS	INCOME COMP. H : M : L			AVERAGE TARIFF	PROFIT RATE
ZONA 1	131.8	11	5	58	38	5.00	40.78
ZONA 2	79.3	7	0	73	28	5.35	41.46
ZONA 3	138.1	11	0	63	38	4.75	40.51
ZONA 4	11.6	1	0	93	8	6.55	53.50
ZONA 5	241.6	19	0	48	53	3.85	27.52
ZONA 6	269.6	21	0	53	48	4.15	33.40
ZONA 7	584.7	45	0	73	28	5.35	48.95
ZONA 8	56.7	5	0	53	48	4.15	24.55
ZONA 9	10.0	1	65	35	0	10.25	65.28
ZONA 10	42.4	4	85	15	0	11.25	70.22
ZONA 11	214.6	17	10	90	0	7.50	62.52
ZONA 12	158.8	13	25	63	13	7.50	61.27
ZONA 13	114.0	9	30	53	18	7.45	62.40
ZONA 14	82.6	7	85	13	3	11.10	72.90
ZONA 15	81.9	7	80	13	8	10.55	71.27
ZONA 16	35.2	3	0	53	48	4.15	27.03
ZONA 17	55.6	5	0	63	38	4.75	32.85
ZONA 18	407.9	32	0	58	43	4.45	37.44
ZONA 19	57.8	5	0	53	48	4.15	26.09
ZONA 21	155.5	12	0	73	28	5.35	48.81
ZONA 24	0.0	1	0	53	48	0.00	0.00
ZONA 25	0.0	1	0	53	48	0.00	0.00
Mixco	432.9	34	5	38	58	3.80	26.65
Villa N	0.0	1	0	53	48	0.00	0.00
Villa C	0.0	1	0	53	48	0.00	0.00
SC.Pinu	0.0	1	0	78	23	0.00	0.00
Chinaut	123.7	10	0	43	58	3.55	19.17

FOOTNOTE :

1. COLLECTION
   - (1) COLLECTION VEHICLE
     - CAPACITY 15.0 m^3
     - LOAD FACTOR 70.0 %
     - RESERVE 20.0 %
   - (2) NUMBER OF TRIPS 1.5 /wd
   - (3) NUMBER OF HELPERS 4.0 persons/vehicle
   - (4) DENSITY 0.248
2. FINANCE
   - (1) TARIFF
     - HIGH INNCOME 12.0 Q/month,house
     - MIDDLE INCOME 7.0 Q/month,house
     - LOW INCOME 1.0 Q/month,house
   - (2) PERSONNEL COST
     - OWNER 600.0 Q/month,person
     - HELPER 250.0 Q/month,person
   - (3) FUEL&MAINTE.COST 500.0 Q/month,vehicle
   - (4) OTHER COST (2) * 10.0 %

that the variables which are in play do not permit rigid norms nor guides.

h. The subscription of the corresponding administrative or open contract will follow the negotiations and granting of the concession by the Municipality.

i. The Municipality will bring the Register of Private Collectors up to date and, in order to be able to ask for a concession, it will be an essential requirement to be registered in the above mentioned Municipal Register.

j. In order to be able to ask for a concession it will be an essential requirement to have working experience as a private collector, which will be collaborated and certified by the DLP.

k. Only those private collectors who have worked in a constant manner as before Dec. 31, 1991, can be registered in the Municipal Register.

l. The private collectors who have obtained a concession will not be able to request the granting of a new zone, at least not until Dec. 31, 1995.

2) Nature of the service

a. The service to be given in the zones with concessions will be exclusively that of collectors of solid waste generated within the concessioned zone.

b. The concessionaire will be obliged to collect the total amount of residential solid waste

generated in the zone using the procedures, routes, frequencies, schedules and specifications approved by the Municipality.

c. He can also collect solid waste generated by business and small industries in the concessioned zone; this work not being able to be done by other private collectors.

d. Commercial and industrial companies which have their own collection services must request the corresponding authorization from the DLP to be able to operate.

e. It will be definitely prohibited for the concessionaire of a zone to collect or transport dangerous and/or toxic solid waste.

f. The solid waste generated in public establishments (schools, hospitals, etc.) will be collected by the Municipal Service. However they will have the option of using the service of Private Collectors, being charged the average domestic service fee.

3) Conditions of the service

a. The DLP will clearly delimit the concessional zone and its location.

b. The explicit acceptance by the concessionaire of the municipal norms and rules which regulate this service.

c. Acceptance by the concessionaire to give the collection service according to the technical specifications of the DLP, which include frequencies, schedules, collection methods, and

diagram of routes.

d. Explicit acceptance of the concessionaire to collect the total amount of solid waste generated in the concessioned zone.

e. Acceptance by the DLP of the Implementation of new methods of collection or procedures proposed by the concessionaire.

f. The highest tariff that the low income residents in the zone will be charged, and the type of collection service they will be given will be defined.

g. The highest tariff that users of domestic service zones will be charged, and the characteristics of the service they will be given (door-to-door collection, intradomiciliary collection, collection of a multi-family container, etc.) will be defined.

h. The tariff scale that commercial and industrial users will be charged will also be defined together with the service characteristics.

i. The concessionaire will give all the guaranties required by the Municipality to permanently ensure the complete number of daily vehicles to cover the service demand. He should also permanently have stand-by vehicles at hand which will guarantee the continuity of the collection service.

j. The number, characteristics, register, and identification of the vehicles,including the stand-by vehicles, will be consigned in detail in the contract of the granting of the

concession. These vehicles are destined exclusively to the collection service in the concessioned zone. Therefore, the use of these vehicles in zones other than those of the concession is prohibited. Violators will be sanctioned and their reincidence could cause the termination of the concession.

k. The outlined population for the loading capacity calculation of the collection vehicles of the concessionable zone will be five years, which is the duration of the concession.

l. The number of stand-by vehicles will be defined by the Municipality in function and in proportion to the years and proposed vehicles for the concessionary service have been in use. In any case, the stand-by minimum will be 10% of the vehicle fleet.

m. The concessionaire must replace the vehicle or vehicles of the service fleet, or of the stand-by fleet, that for reasons of obsolence or imperfections are put out of commission during the period of the concession.

n. The concessionaire is exclusively obliged to transport all the solid waste collected to the sanitary landfills that the Municipality operates. The infractors will be sanctioned and their reincidence could cause the revoking of the concession.

o. All vehicles used by the concessionaire will have adequate systems, automatic or adapted, for a quick discharge in the landfills. The discharge should not take more than seven minutes.

p. At the granting of concessions starting on the 1st of the January, 1996, no vehicles manufactured before 1980 will be accepted.

q. Any modification in the rates that the users are charged must be previously approved by the Municipality. The breach of this regulation will be the cause for revocal of the concession.

r. The concessionaire and his collection personnel may segregate and recover the materials contained in the collected solid waste with the purpose of recycling, as long as the sanitary and safety rules of the activity are followed.

4) Other conditions for the concession

a. The concessionaire has the obligation of keeping accounting books in accordance to the law, which will make verification possible by the Contraloria General de Cuentas when it is required by the Municipality to determine the financial state of the company. (Art. 33, b.).

b. The acceptance of the concessionaire, to make the accounting books and documents available to the Municipality and of providing any required information, in case the service is intervened. (Art. 33, c.).

c. The duration of the concession in each of the concessioned areas is five (5) years; its renewal for another period of the some length must be applied for within the last three months of the initial period.

d. The concessionaire must comply with all the technical requirements of vehicle and equipment inspection and operation of the service as determined by the Municipality, as well as the payment of rates and municipal taxes determined by the Municipal Corporation.

e. However, the Municipality could consider exempting or reducing the tariff charged to the collectors for discharging solid waste in the sanitary landfills.

5) Intervention and revocation of the concession

a. The concession will be intervened by the legal motives and following what is stipulated in Art. 34 of Municipal Code.

b. The concession of the private collection may be revoked in any of the following events:

- When it is harmful to the interests of the Municipality
- If it violates regulations in relation to public order and social interest
- If it violates regulations of general or local character in relation to public health and hygiene.

In any of these events the contentious management procedure is excluded. (Art. 35)

6) Prohibitions and sanctions

a. The persons which come under any of the circumstances indicated in Art. 48 of Decree number 35-80 are forbidden from applying for concessions.

b. The failure to fulfill and infractions of the contract will be sanctioned in accordance to the degree of the violations, with fines that may reach up to 10% of the monthly income as concept of payment of tariffs in the granted zone. Reincidence may cause the revoking of the concessions.

(3) Criteria for the conferring of concessions

The fundamental criteria is as follows:

1) Exclusively to grant concessions to the current private collectors registered in the Municipality, because of the experience they already have.

2) The grant is a process of negotiation between the Municipality and the concessionaire, which must be discussed and based on the guidelines and conditions proposed in this document.

3) Proposed plan for the concessionaire to collect all solid waste in the granted zone.

4) Tariff plan and structure proposed by the concessionaire.

5) Plan and method proposed by the concessionaire for the collection in poor and low-income areas and highest tariff that he proposes to charge.

6) Guarantees that the concessionaire offers to permanently have the agreed number of vehicles for the service, as well as the stand-by vehicles.

7) Organizational and financial plan proposed by the concessionaire to modernize and make his company

more efficient.

(4) Contracting of concessions

The concession contract of a (determined) zone for private collection will be drawn up by the Municipal Judicial Department.

3.2.2 Gradual Granting of Concessions

As a result of the Second Field Study and of the evaluation of tables I-3-4, I-3-5 and I-3-6, the gradual granting of concessions should be subject to the following guidelines:

(1) Easy collection in the Zone
(2) financial income yield capacity of the Zone
(3) Less possibility of conflicts between collectors
(4) The following program for the granting of concessions is presented tentatively:

1991	1 zone
1992	3 zones
1993	3 zones
1994	4 zones
1995	4 zones

(5) These first fifteen recommended zones to be granted in the 1991-1995 period are those corresponding to Zones 1 through 15.

(6) The most recommended financial feasibility of the concessionable Zones, shown in table I-3-6, is based on the following premises:

- Average truck capacity: 15 m^3
- Volume occupied by load in each truck: 70%
- Stand-by trucks: additional 20%, because they are