Chapter 18

Impacts on Solid Waste Management by the Hurricane Mitch

18 Impacts on Solid Waste Management by the Hurricane Mitch

18.1 Introduction

18.1.1 Background to this Field Survey

This study commenced in December 1997 and the draft final report was submitted in October 1998. The final report was supposed to be submitted in December 1998 in line with the discussion on the draft final report.

However, the whole country in Honduras was hit by the devastating Hurricane Mitch in late October, just after the submission of the draft final report. It caused serious damage to the whole country and the Central District. In order to aid Honduras, many foreign governments, international aid agencies, NGOs, etc. provided Honduras with urgent support.

The area covered by this study was severely damaged. The hurricane caused the Choluteca River to overflow, flooding many surrounding areas as well as causing numerous landslides, and generating a large amount of hurricane waste, such as debris and mud. The Cleansing Department of AMDC and other organizations urgently began to remove the waste and transport it to the existing disposal site for municipal waste. However, a huge amount of hurricane waste still remains in the city.

The disaster will have serious negative impacts on the technical and financial aspects of future solid waste management, which can not be ignored. Thus the necessity for partial change of the SWM Master Plan prepared in the Study. To this end, JICA has decided to carry out this supplementary study.

18.1.2 Schedule of the Supplementary Study

The schedule of the supplementary study:

- Survey Work in Honduras: from 7 February 1999 to 5 March 1999
- Work in Japan: from 8 March 1999 to 30 March 1999
- Distribution of Final Report: April 1999

18.1.3 Policy for the Supplementary Study

- To minimize changes to the SWM Master Plan already formulated.
- To formulate a short term plan which will be implemented sooner. The Feasibility Study will be conducted on the priority projects and will be included in the short term plan.

18.1.4 Contents of the Supplementary Survey

a. Survey Works done in Honduras

The Study Team carried out the surveys on the following items in Honduras.

a.1 Field Reconnaissance

- Collection and Haulage
- Final Disposal
- Street Sweeping
- Equipment Maintenance
- Economic and Financial Condition
- International Donor Agencies

a.2 Revision of the Master Plan Framework

- Economic Forecast
- Population Forecast
- Waste Amount Forecast

a.3 Preparation of the Progress Report (2)

b. Work to be done in Japan

The following works will be conducted in Japan.

- Formulation of revised SWM Master Plan.
- Feasibility study on the priority projects.
- Supplementary report compiling above results.

18.2 Damage in the Central District due to Hurricane Mitch

18.2.1 Adverse Impacts resulting from the Hurricane

a. Whole Country

a.1 Damage

Damage (human toll and infrastructure) throughout the entire country resulting from Hurricane/Tropical Storm Mitch is shown in Table 18-1.

Table 18-1: Damage produced by Hurricane Mitch in the Departments of Honduras

Department	Deaths*		Injured**		Missing Persons**		Bridges Destroyed		Roads Damaged	
	No.	%	No.	%	No.	%	No.	%	No.	%
Atlántida	610	9			271	3.4	9	5	2	4
Choluteca	1,200	17	5,863	48.9	268	3.3	17	9	4	9
Colón	455	6	76	0.6	627	7.8	16	8	3	6
Comayagua	395	6	1,624	13.5	856	10.6	3	2	2	4
Copán	17	0					1	1	1	2
Cortés	709	10	3,207	26.7	1286	16.0	11	6	3	6
El Paraíso	111	2	402	3.3	145	1.8	3	2	2	4
Fco. Morazán	1,000	14	9	0.1			49	26	6	13
Gracias a Dios	29	0			607	7.5	2	1	1	2
Intibucá	11	0	20	0.2			6	3	2	4
Islas de Bahía	16	0			575	7.1	2	1	1	2
La Paz	4	0	102	0.9			6	3	2	4
Lempira	3	0	7	0.1			4	2	2	4
Ocotepeque	13	0	610	5.1	5	0.1	2	1	1	2
Olancho	403	6	57	0.5	94	1.2	16	8	3	6
Sta Bárbara	495	7			3,233	40.1	14	7	4	9
Valle	625	9			23	0.3	9	5	3	6
Yoro	911	13	21	0.2	62	0.8	19	10	5	11
TOTAL:	7,007	100	11,998	100	8,052	100	189	100	47	100

Source: Preliminary data of CODER, COPECO, SETCO, Nov.1998.
* Final data as Dec. 2, 1998: 5,642 deaths.
** Final data as Nov. 16th: 12,275 injured, 8,058 missing.

Some of the data are being reviewed and updated by the national agencies.

a.2 Duration, Strength and Evolution of Hurricane Mitch

Hurricane Mitch hit Honduras during the week of October, 25th--31st. On October 21st Mitch developed in the Caribbean Sea, about 576 km south of Kingston, Jamaica, becoming a tropical storm. On the morning of October 24 it was upgraded to a hurricane. Firstly it hit Swan Island (Oct. 25th) and then it moved south-west to the Bay Islands (Oct. 27th). The center of the hurricane moved southwards to the mainland passing near Trujillo (Oct. 29th) weakening to a tropical storm. On October 30 it passed through the central region of Honduras, including Tegucigalpa and then continued westward penetrating Guatemala.

The path and evolution of the hurricane is shown in the following Table 18-2:

Table 18-2: Path and evolution of Hurricane Mitch (Oct. 23rd---Nov. 4th. 1998)

Date (Local time)	Wind Velocity (Max. sustained) Km/hr	Category (Saffir/Simpson Scale)	Barometric Pressure (MB)
Oct. 23rd, 10 a.m.	95	Tropical storm	999
10 p.m.	95	Tropical storm	997
Oct. 24th, 10 a.m.	160	2	987
10 p.m.	195	3	965
Oct. 25th, 12 a.m.	200	3	953
12 p.m.	235	4	929
Oct. 26th, 12 a.m.	240	4	922
12 p.m.	273	5	906
Oct. 27th, 12 a.m.	285	5	918
12 p.m.	250	5	928
Oct. 28th, 12 a.m.	220	4	933
12 p.m.	195	3	948
Oct. 29th, 12 a.m.	160	2	970
12 p.m.	120	1	990
Oct. 30th, 12 a.m.	65	Tropical storm	997
12 p.m.	85	Tropical storm	1,000
Oct. 31th, 8 a.m.	55	Tropical depression	1,001
8 p.m.	55	Tropical depression	1,002
Nov. 1st, 8 a.m.	45	Tropical depression	1,005
Nov. 3rd, 5 p.m.	70	Tropical storm	997
8 p.m.	65	Tropical storm	997
Nov. 4th, 12 a.m.	65	Tropical storm	997
2 a.m.	55	Tropical depression	998
8 a.m.	75	Tropical storm	998

Source: CEPAL, Honduras: Evaluacion de los daños ocasionados por el Huracán Mitch, 1998

a.3 Daily Precipitation in Main Cities

Daily precipitation in the six most affected cities in Honduras is shown in Table 18-3.

Table 18-3: Rainfall in 24 hrs in six most affected cities during the Hurricane Mitch (Oct/98) (mm)

Day	25th	26th	27th	28th	29th	30th	31rst	Total
1.Choluteca	10.0	8.7	44.7	17.5	196.2	167.7	466.7	911.5
2.La Ceiba	3.0	166.4	284.1	244.4	116.5	58.0	2.4	874.8
3.Balfate	71.0	260.0	260.1	54.5	64.2	4.2	0.2	714.2
4.Tela	32.0	139.2	105.1	170.9	74.4	25.5	18.4	565.5
5.Sabanagrande	12.9	21.1	24.5	23.6	70.8	186.2	30.0	369.1
6.Tegucigalpa	0.4	2.3	13.7	10.7	15.6	119.4	119.1	281.2

Source: Seccion de Climatologia, Direccion General de Aeronautica Civil, SOPTRAVI
Note: La Lima Station (near San Pedro Sula) was flooded, so no data was taken

b. In the Central District

b.1 Duration of the Hurricane in the Central District

As was observed previously (Tables 2.2 and 2.3) when Hurricane Mitch hit the Central District on October 30th and 31st, it had already weakened to a tropical storm.

b.2 Comparison to other previous Hurricanes hitting Tegucigalpa

The power of the Hurricane Mitch can be compared with the previous biggest recorded hurricanes as follows Table 18-4:

Table 18-4: Comparison of precipitation of the biggest hurricanes hitting Tegucigalpa

Hurricane	Period	Precipitation (mm)	%
Mitch	1998-10-(25-31)	281.2	100
Fifi	1974-09-(17-20)	97.1	35
Gert	1993-09-(15-18)	73.9	26
Alma	1966-06-(1-6)	70.3	25
Francelia	1969-09-(1-4)	44.5	16

Source: Seccion de Climatologia, Direccion General de Aeronautica Civil, SOPTRAVI

Hurricane Mitch had almost three times the precipitation than Fifi, and about four times Gert and Alma.

b.3 Damage in the Central District

In the Central District most of the damage was produced by the flooding and landslides in the urban areas.

The most up-to-date data regarding casualties in the D.C. gives 300 deaths, 80 injured and 11,000 persons still in refugee shelters. The number of persons taken to shelters in the first days after the hurricane reached about 250,000 people.

Although traditionally the number of districts (barrios/colonias) considered to be at risk was 88 (17% of the total), this number increased to 122 (24%), as a result of the effects of the floods and landslides.

According to a map of flooded areas and landslides prepared by SOPTRAVI, the net flooded area was about 260 ha, and the area of landslides was about 110 ha (see Figure 18-1).

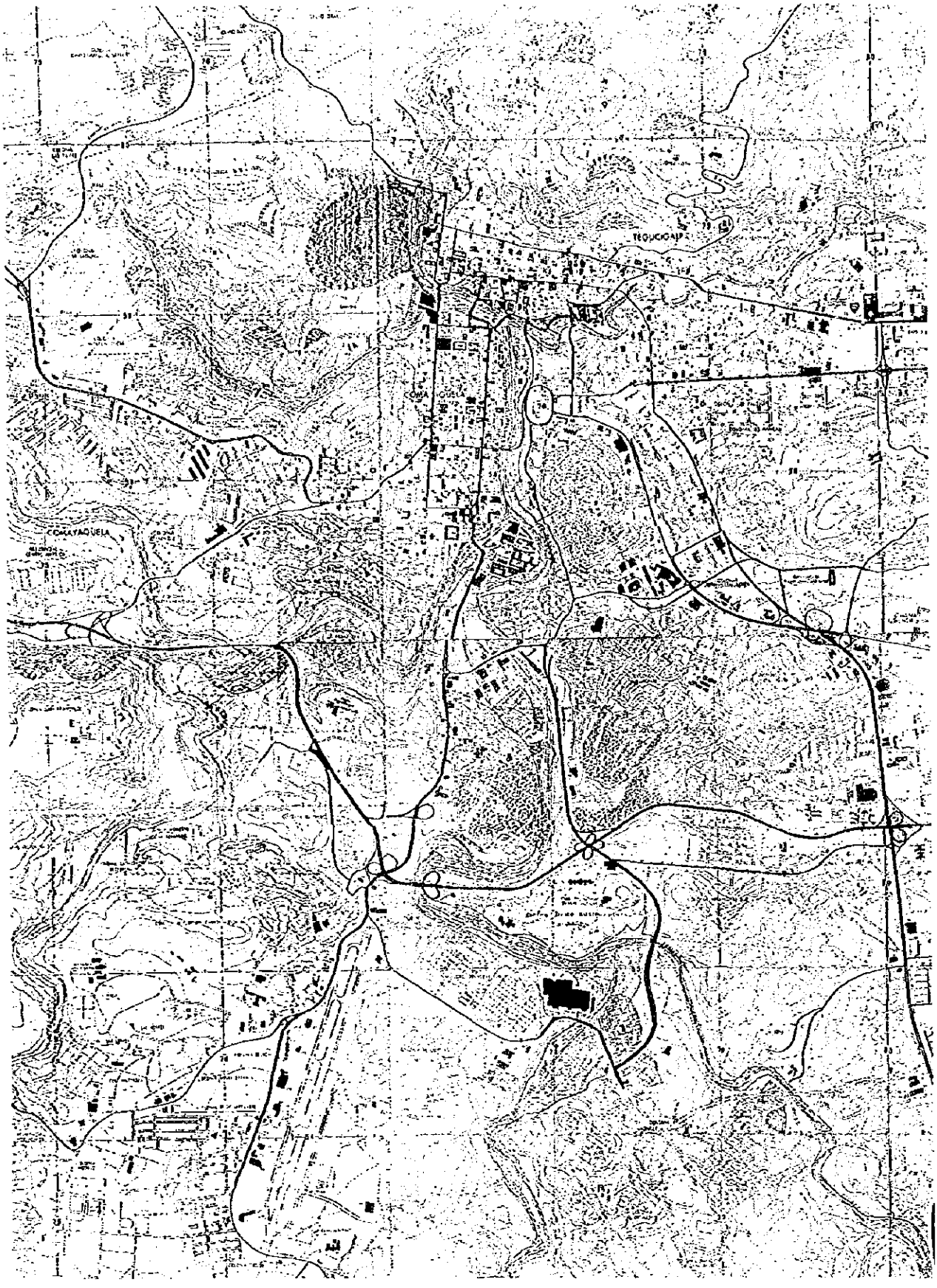


Figure 18-1: Zone of Floods and Landslides Caused by Mitch in the Central District

Both phenomena (flood and landslides) produced loss of property in the urban areas of the Central District as is shown in Table 18-5.

Table 18-5: Damages to Buildings per Central District Sector

Number of Destroyed Buildings per Sector in the Central District						
Sector	Total	100%	75%	50%	No. of	percent
	(A)				Building	(A/B)
					1998 (B)	%
1	205	84	32	89	1,768	11.6
2	125	95	21	9	3,114	4.0
3					1,762	0.0
4	84	21	5	58	2,181	3.9
5	50	11	26	13	1,454	3.4
6	217	117	50	50	4,032	5.4
7	268	197	9	62	13,726	2.0
8					2,211	0.0
9	77	59	3	15	4,872	1.6
10					2,703	0.0
11	108	5	19	84	2,430	4.4
12	221	112	45	64	3,459	6.4
13	45	22	6	17	14,283	0.3
14					2,461	0.0
15					745	0.0
16					6,045	0.0
17					3,652	0.0
18					7,403	0.0
19	2	2			4746	0.0
20					9,453	0.0
21	1	1			10,132	0.0
22	33	7	10	16	3,670	0.9
23	13	4	5	4	4,242	0.3
24	23	17	2	4	4,940	0.5
25					2,853	0.0
26					289	0.0
27					331	0.0
28					2,118	0.0
29					4,630	0.0
Total	1,472	754	233	485	125,705	1.2

Source: Cadastral Department, AMDC, Feb. 1999.

Moreover, according to SOPTRAVI, 7 bridges were destroyed and 6 other were severely damaged.

The economic loss is evaluated in the economic section.

18.2.2 Emergency Activities Taken by the Cleansing Department Immediately Following the Hurricane

Immediately following the Hurricane Mitch in the Central District, the Cleansing Department, maintained close coordination with the Municipal Emergency Committee(CODEM), participating in the following activities:

Logistic support to different institutions which CODEM comprises, such as COPECO (Permanent Committee of Contingencies), fire department., Health Ministry, armed forces, volunteer groups which arrived in the country, resident associations, villages, and several departments of the AMDC.

Rescue actions and evacuation of persons of at least 30 districts of the D.C., using 9 trucks and 2 backhoes.

Cleaning of streets and transportation of waste with micro-enterprises workers.

Support to at least 3,000 students from middle schools and universities students who volunteered, working in the districts of La Hoya and EL Jazmín.

Removing debris and mud in the flooded areas of Tegucigalpa.

Planning of rescue and cleaning activities with teachers and students for the distribution of work.

Cooperation with a group from the Mexican army who performed cleaning activities in the zone of Comayagüela.

18.2.3 Remaining Works Related to the Cleansing Department as of February 1999

Hurricane waste still to be removed is concentrated mainly in the District of El Jazmín in Tegucigalpa; Alvarez Market; and in 1st, 2nd and 3rd avenues of Comayagüela between 1st and 9th streets.

These are middle and high class areas so did not qualify to receive official aid from the government, although they suffered heavy damage.

On 8 January 1999, the Municipal Corporation of the AMDC, issued a bylaw ordering the people of such areas to clean up the affected areas by themselves (houses, commercial buildings and yards), offering at the same time an assistance program to those who request it.

This program is being coordinated and financially supported by the UNDP, contracting the necessary equipment for the cleansing, with the cooperation of the staff of the AMDC Cleansing Department.

At present it has been estimated that 35,000 m^3 of waste and debris remains.

Also remaining is sediment and debris deposited on the bed of the Choluteca River, which has been estimated at 15 million m^3. This is a project which is being negotiated with the private companies. At present the World Bank has offered US$5 million in order to start the work.

18.3 Current Situation of the Solid Waste Management

18.3.1 Hygiene Condition of the City

The appearance of the Central District as of February 1999 is generally clean except,

- some places of low income residential areas that currently do not receive regular waste collection services, and
- around waste containers in which waste is overflowing.

This condition is generally the same as before the Hurricane Mitch.

However, we would like to point out the condition of waste scattered around containers has worsen. This is deemed not to be due to the hurricane but because of the improper management of the container collection system.

18.3.2 Technical System

18.3.2.1 Collection and Haulage

a. Collection and Haulage Route

Although fourteen bridges in the Central District were washed away by the flood, in the area where waste collection service is provided, only the Juan Ramón Molina bridge which connects Tegucigalpa and Comayaguela below the National Stadium was washed away by the flood. However, a Bailey-type bridge which was assembled there by U.S. Marine Corps was inaugurated on 16th February 1999. This can hold more weight than the previous one. This inauguration, therefore, returned the collection and haulage routes to their former state.

b. Waste Collection Equipment and Facilities

The following equipment was washed away by the flood.

1. One 12 m^3 container (12 still remain)
2. One 5 m^3 container (10 still remain)

Therefore it can be said that the actual loss of equipment due to the hurricane is small and the negative impact to the AMDC's waste collection and transportation capacity is negligible.

The waste hoppers ("rampa") at the San Isidro market was destroyed and is now not usable because the river bed level rose due to the sediment of mud. It caused the waste collection work for this market very inefficient.

c. Maintenance of Equipment

We point out that the operation rate of the AMDC's fleet, especially the Fiat compactors and Fiat dump trucks purchased in 1988, has decreased markedly from 80% last year to 50% this year. This is due to:

- overuse of vehicles for removing huge debris after the hurricane;
- not purchasing necessary spare parts in a timely manner; and

- their age.

If necessary spare parts are obtained in time, their operation rate is expected to improve to 70%. However, the Fiat vehicle requires high maintenance cost due to their age. It can not be expected that the Fiat vehicle will be able to work after a few more years.

18.3.2.2 Final Disposal

a. Disposed of Hurricane Wastes

The amount of hurricane waste carried to the existing disposal site for municipal waste since October 1998 when the Hurricane Mitch hit the Central District has not been recorded. Therefore, we are determining it based on the difference between the topography of February 1999 and July 1998. Reliable data will be obtained soon.

According to observations by the AMDC's supervisor for the disposal site and our visual observation, approximately 300,000 m^3 of hurricane waste has been disposed of.

Regarding its composition, the hurricane waste consists mainly of soil. It contains some building debris and trees as well. The soil was generated from by soil removed from the streets in the areas which were inundated and also by collapse of the buildings made of traditional earth blocks, "adobe", which is not durable to flowing water.

Most of hurricane waste which has been disposed of seems to be suitable for soil cover. Therefore, it can be excavated and utilized for covering waste later.

b. Reserve Volume of the Existing Disposal Site

Based on the topographical survey data and the development master plan of the disposal site which prepared in the Study, the reserve volume was 2,440,000 m^3 and it was enough for receiving waste collected until the end of 2006.

A more accurate reserve volume, as of February 1999, will be determined based on topographical survey data which is currently being collected.

According to visual observations, approximately 300,000 m^3 of hurricane waste has been disposed of there. This is equivalent for the waste amount collected over one and half year. It implies that the remaining useful life of the existing disposal site has been shortened by one and half years, in other words, enough until 2004.

c. Condition of Landfill Equipment

At the landfill site there are three bulldozers (Caterpillar D.H.T.). As of December 1998 one had been operated for about 5,200 hours and the other for 1,600 hours.

Because their exists no regular or appropriate maintenance the equipment is in constantly being repaired. Hence the bulldozers have only consumed 25% of their useful lives.

The evaluation of the equipment in December 1998 reports the following:

Plates	Horometer Reading	Cost to Repair
4AB05510	5110	US$14,000.00
4AB05511	5193	US$1,800.00
4AB05512	1641	US$1,800.00

For equipment that the Caterpillar agent in Honduras valued at US$900,000.00, the cost to repair represent only 1.95% of its total value.

d. Facilities in the Disposal Site

The 350m access road from the Olancho Road to the filling area that was paved last July as a part of the pilot project "Experiment on the Improvement of Existing Final Disposal", has remained in good condition. We would like to point out that many trucks carrying hurricane waste were able to enter the disposal site immediately after the hurricane because of this paved access road.

The other facilities such as the entrance gate, signboards, a site office, a store house, wire fence, net fence to prevent waste scattering have not been damaged.

The animal trap at the entrance has been filled with soil. Therefore animals can enter the disposal site now.

No slope failures at the disposal site were observed.

18.3.2.3 Street Sweeping

The street sweeping works are conducted by two methods: one is directly operated by the AMDC's workers and the other is operated by micro-enterprises contracted by the AMDC.

The total number of street sweeper employed directly by AMDC has not been changed remarkably.

Table 18-1 shows that the number of micro-enterprises increased since last August and the contract rate increased by 6.5%.

This changes is deemed not due to the Hurricane Mitch but due to the inflation.

The number of micro-enterprises has increased by 15. This is due to the AMDC's policy to extend such works to micro-enterprises.

Table 18-1: Street Sweeping Micro-Enterprises for

Category	Number of Enterprises		Contract Rate	
	Aug. 1998	Feb. 1999	Aug. 1998	Feb. 1999
	enterprises	enterprises	Lps/4months	Lps/4months
Micro-enterprise for sweeping street in the city	43	50	62,000 (Lps 2,214/p/m)	56,600 (Lps 2,358/p/m)
Micro-enterprise for cleaning parks, trees, water course	0	8	N.A.	60,000

18.3.3 Economic and Financial Condition

18.3.3.1 Socioeconomic Situation

Hurricane Mitch effected the Honduran economy seriously. The estimated damage to infrastructure was about US$1,928.7 million, and the decrease in Gross Domestic Product (GDP) during 1998 and 1999 has been estimated to be about US$832 million.

Totally the direct impact has been estimated to be US$2,760.8 million, that means to be about 60% of annual GDP.

The damage to road networks and bridges was very big and it is said that the reconstruction costs will reach to US$469.5 million. Water supply systems were also damaged including SANAA's fee charging system, and it is said that damage to SANAA is US$108.6 million. The urban administration systems of San Pedro Sula and Puerto Cortes were damaged, which has been estimated to be US$70.0 million, and houses received US$38.5 million worth of damage.

In the production sector, the agriculture and livestock were effected severely. In the last two months, the damage reached US$ 185.1 million. The manufacture got the damage of US$ 155.8 million, and the sector of commerce, restaurant and hotel got the damage of US$ 38.5 million.

As indirect damage, the decrease in exports has been estimated to be US$600 million, while the imports increased by US$700 million. The revenue of Central Government has decreased by US$304.2 million (Necesidades Urgentes y Lineamientos del Plan Maestro de la Reconstruccion Nacional).

The results being that GDP in 1998 decreased 2 percentage points from the preliminary forecasted figure to 2.8%. The GDP in 1999 will be 2% less than that of 1998. (El Heraldo, 9 February,1999)

On the other hand, the United Nations Economic Commission for Latin America and the Caribbean (CEPAL) estimated that direct damage was US$2,004.7 million, indirect damage was US$1,788.9 million, the reconstruction costs were US$2,472.0 million and the effects to the balance of payments was US$1,256.9 million. As a result, the GDP in 1998 was estimated to decrease by 2.7%, and that of 1999 will decrease by 6.8%.(Honduras: Evaluacion de los Danos ocasionados por el Huracan MITCH)

18.3.3.2 Negative Effects due to the Hurricane on Municipal Finances

While many bridges collapsed and slope failures destroyed many sections of the road network, the total amount of damage has not been calculated.

Concerning the damage to houses, the effects were limited to specific areas, only 1.2% of houses were more than 50% destroyed. The decrease in the amount of waste tax collected from the joint-billing with property taxes is estimated to be 1.5% as shown in the following table.

Table 18-2: Buildings destroyed according to value by Mitch

Items	Unit	Classification of Building based on Value										Total
	$X10^3$Lp	-25	-60	-100	-200	-300	-600	-800	-1,000	-1,500	>1,500	
100% Damaged	nos	263	174	114	85	38	31	13	10	8	14	750
75% Damaged	nos	8	41	48	41	20	29	11	8	8	22	236
50% Damaged	nos	27	86	99	86	77	56	17	9	9	20	486
Total (A)	nos	298	301	261	212	135	116	41	27	25	56	1,472
No. of total buildings (B)	nos	31,029	38,520	18,503	16,599	6,408	7,015	1,669	1,121	1,903	3,208	125,975
percent (A/B) %		1	1	1	1	2	2	2	2	1	2	1

Source: Catastro Department

Municipal revenue actually increased despite the effect of the disaster.

The collection of the property tax has increased in September because of the introduction of identity codes with the billing system. The total property tax in 1998 increased by 46% compared to 1997. Over the last 5 months of 1998, the collection increased by 51%. In October the collection decreased by 18% on the previous year because of Mitch. But in November, the collection increased by 55%. The collection in December increased by 93% compared to the previous year.

The collection of waste tax increase even more improvement because of the introduction of identity codes. The total waste tax in 1998 increased by 43% compared to that of 1997. In the last 5 months, the collection increased by 116%. In October the collection decreased by 79% on previous year because of Mitch But in November, the collection increased by 47%. The collection in December increased by 193% compared to the previous year. The increase in December was a result of campaign urging residents to pay of taxes.

The collection of direct taxes also improved.

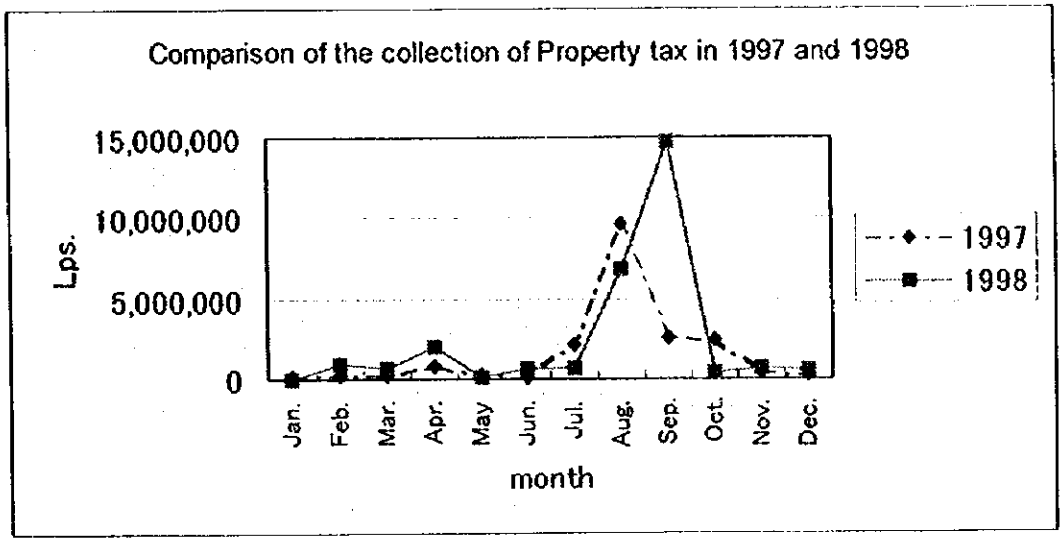


Figure 18-1: Comparison of the collection of Property tax in 1998 and 1999

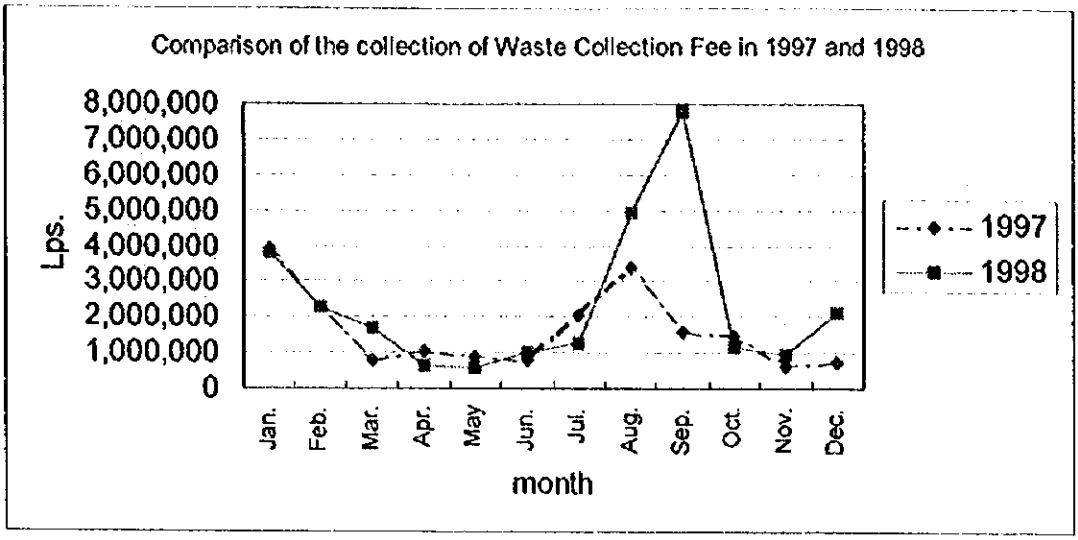


Figure 18-2: Comparison of the collection of Waste Collection Fee in 1997 and 1998

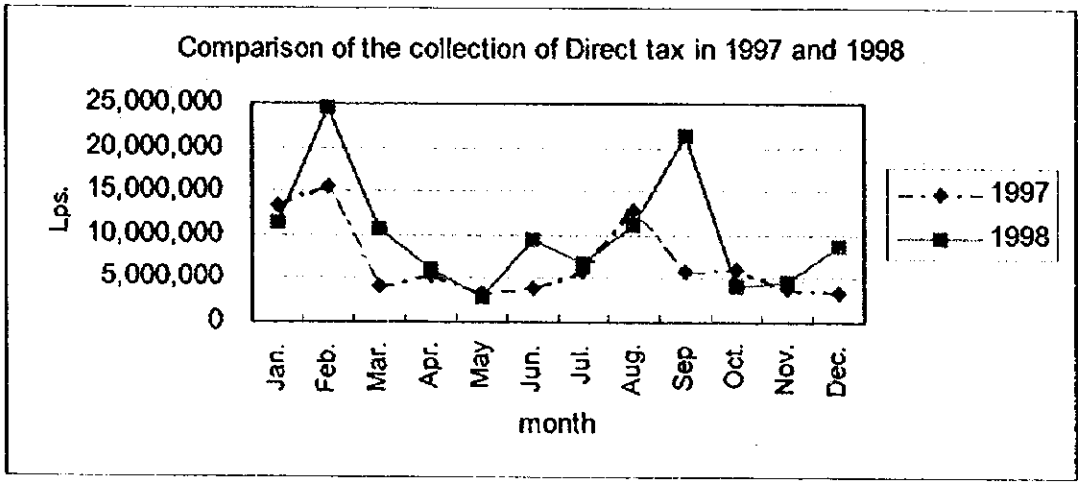


Figure 18-3: Comparison of the collection of Direct tax in 1997 and 1998

The improvement in the collection of municipal taxes increased the Inter-American Development Bank's (IDB) faith in the current AMDC administration. The IDB subsequently approved a loan for US$40 million, which includes US$1 million for SWM improvement. The loan has a 40-year repayment period with a 10-year grace period. Interest is 1% during the grace period and 2% for the following 30 years. The first US$12 million of the loan, including US$500,000 for SWM improvement, under the loan agreement, should be spent before September of 1999.

Municipal expenditure during 1998 is being investigated.

Newspapers reported that the AMDC received a loan of Lps.20 million for salaries and bonuses for the last final 2 months of1998, and a loan of Lps.40 million for the expenses incurred during Hurricane Mitch.

The 1999 municipal budget is Lps.561.4 million, 1.36 times the size of the 1998 primary budget. Actual revenue in 1998 was Lps.345.5 million, therefore the AMDC

must collect 1.62 times more revenue this year than it did in 1998. The revenue plan is expected to increase the public service fee as shown in the following table.

Table 18-3: Changes in Municipal Revenue

Items	Municipal Revenue (1,000 Lps)				Ratio	
	1997	1998	1998	1999	1998/1997	1999/1998
	Actual (A)	Budget (B)	Actual (C)	Budget (D)	(C/A)	(D/B)
Total Revenue	181,324	412,395	345,539	561,447	1.906	1.361
Current Revenue	179,633	281,895	237,418	273,254	1.322	0.969
Direct Tax	83,400	164,475	122,154	110,655	1.465	0.673
Indirect Tax	9,061	26,400	12,616	19,480	1.392	0.738
Recovery of bills	28,389	58,300	29,459	58,156	1.038	0.998
Public Service Fee	57,920	30,720	71,949	84,191	1.242	2.741
Rental Fee	863	2,000	1,239	771	1.436	0.386
Capital Revenue	1,691	130,500	108,121	288,193	63.950	2.208
Transfer	1,257	123,000	103,447	286,000	82.300	2.325
Sales of assets		4,500	767	2,193	-	0.487
Contribution	434	3,000	3,907		9.007	0.000
Reference: within P.S fee						
Waste Tax	19,711	20,000	26,398	30,251	1.339	1.513

Source: Financial Department

One of these policies, the new waste tax on business waste was introduced based on the proposal by JICA study team in the Master Plan on Solid Waste Management. The tariff was simplified based solely on business income rather than the more complex former tariff.

Table 18-4: New Business Waste Fee

Rank of Business Income	Waste Collection Fee (Lps/month)
Up to 50,000.00 Lps.	40.00
50,000.01 - 100,000.00 Lps.	80.00
100,000.01 - 300,000.00 Lps.	125.00
300,000.01 - 600,000.00 Lps.	180.00
600,000.01 - 1,000,000.00 Lps.	240.00
1,000,000.01 - 2,000,000.00 Lps.	325.00
2,000,000.01 - 5,000,000.00 Lps.	500.00
5,000,000.01 - 10,000,000.00 Lps.	700.00
10,000,000.01 - 15,000,000.00 Lps.	800.00
15,000,000.01 - 20,000,000.00 Lps.	1,000.00
20,000,000.01 - 30,000,000.00 Lps.	1,300.00
30,000,000.01 - 40,000,000.00 Lps.	1,500.00
40,000,000.01 - 60,000,000.00 Lps.	1,600.00
more than 60,000,000.01 Lps.	1,800.00

Table 18-5: The Former Business Waste Fee

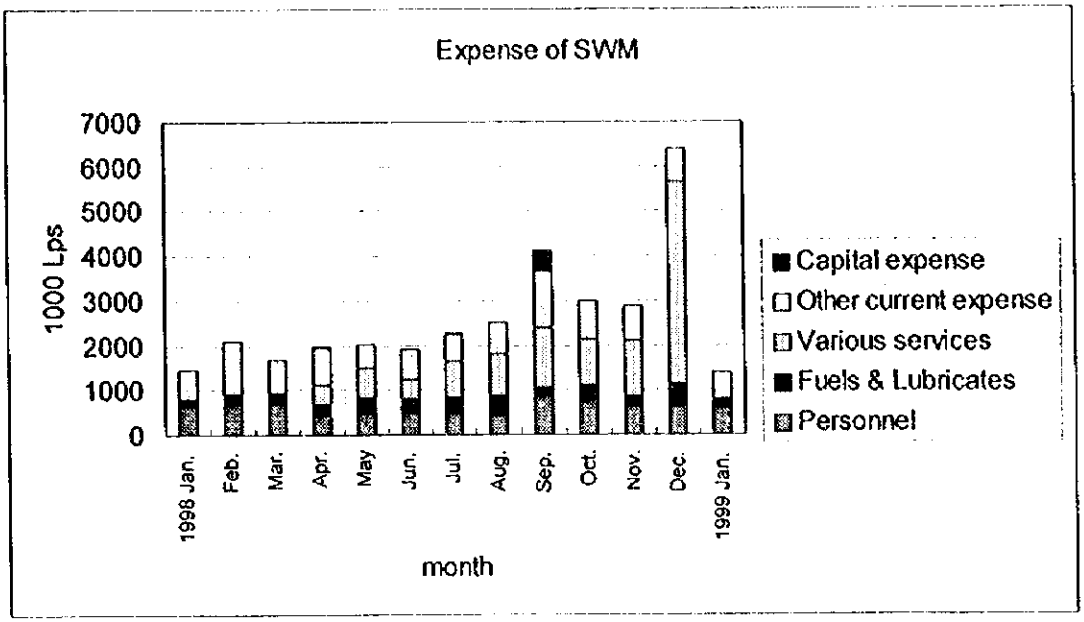
Category		Tariff
Agencies or bank branches, financial institutions and stock brokerages that do not declare an income		Lps.150.00
Law firms, medical consultants, all kinds of sales services carried out by natural entities, charitable institutions and other nonprofit organizations; those that do not affect the industry, trade, and service tax		Lps. 40.00
Institutions, enterprises, or business that declare zero		Lps. 25.00
Billiard parlors, per table		Lps. 20.00
Tire repair shop		Lps. 15.00
Lubrication shops		Lps. 50.00
Bar & Salon	Lps.25,001 -50,000	Lps.100.00
	Lps.10,001 - 25,000	Lps. 80.00
	up to Lps.10,000	Lps. 50.00
Bordello	more than Lps.50,000	Lps.200.00
	up to Lps.50,000	Lps.110.00
Social clubs and other similar establishments		Lps.100.00
Hotels, lodgings, pensions, boarding houses, apartments	with more than 100 rooms	Lps.500.00
	51-75 rooms	Lps.350.00
	26-50 rooms	Lps.175.00
	up to 25 rooms	Lps.100.00
Motels		Lps.500.00
Laborers' living quarters or inns pay according to their income	more than Lps.10,000	Lps. 50.00
	up to Lps.10,000	Lps.20.00
Restaurants and coffee shops	higher than Lps.100,000	Lps.300.00
	Lps.50,001-100,000	Lps.200.00
	up to Lps.50,000	Lps.100.00
All other businesses pay for these services, on a monthly basis, according to their taxable annual income	more than Lps.4,000,000	Lps.500.00
	Lps.3,000,001-4,000,000	Lps.450.00
	Lps.2,000,001-3,000,000	Lps.400.00
	Lps.1,000,001-2,000,000	Lps.250.00
	Lps.500,001-1,000,000	Lps.200.00
	Lps.300,001-500,000	Lps.150.00
	Lps.100,001-300,000	Lps.100.00
	Lps.75,001-100,000	Lps. 75.00
	Lps.50,001-75,000	Lps. 60.00
	Lps.25,001-50,000	Lps. 40.00
	up to Lps.25,000	Lps. 20.00

Source: "Plan de Arbitrios", La Gaceta, 27 Dec.,1997

The revenue in January in 1999 is understudying.

18.3.3.3 The Negative Effects of Hurricane on SWM Budget

Expenditure for SWM is shown in the following figure. It is not certain whether expenses for SWM increased in December are caused by Mitch or not.



Source: Budgetary Department

Figure 18-4: Expense of SWM

Current AMDC expenses, with the exception of personnel expenses and payment for fuels and lubricants, used to be paid after the collection of waste tax, therefore the monthly expenses for SWM did not reflect monthly costs. But expenses in December were covered with loans for the expenses for the last 2 months of 1998.

Personnel expenses decreased gradually after September because of the decrease in the number of employees and contracting out of some SWM services.

On the other hand, the payment for fuels and lubricants increased in last 4 months in 1998.

It was reported that private company waste collection expenses had been paid in advance in January 1999, but the figure does not appear in the list of payments.

Concerning the 1999 budget for SWM, the expenditure is 2.52 times that of the preliminary budget of 1998. The reason why expenditure increases is for the contracting out of SWM services. Costs by private companies are higher than those of the municipality as mentioned in M/P.

Table 18-6: Comparison of 1998 Budget, Actual payment and 1999 Budget for SWM

Unit: 1,000 Lps.

Items	1998				1999
	Approved Budget (A)	Revised Budget after July(B)	Actual payment(C)	Increase (C/A)	Approved Budget
Personnel Expenses	6,760	7,336	7,312	1.08	7,314
Salary	5,250	6,579	6,579	1.25	6,314
Overtime work	950	734	733	0.77	500
Others	560	23	0	0.00	500
Non-personnel expenses	1,293	12,158	12,104	9.36	615
Rental cost of Equipment	1,169	619	577	0.49	500
Various services	112	11,525	11,525	102.90	100
others	12	14	2	0.17	15
Materials & Supplies	5,482	5,671	5,135	0.94	5,735
Fuel & Lubricant	4,000	3,392	3,391	0.85	4,590
Spare parts	610	733	553	0.91	610
Others	872	1,546	1,191	1.37	535
Machinery & Equipment	0	736	511		0
Contracting out	0	0	0		20,500
Total	13,535	25,901	25,062	1.85	34,164

Source: Financial Department

18.3.3.4 Conclusion

Concerning financial aspects, negotiations to introduce the joint-billing system with electricity bill are continuing, and it seems they will be realized this year. AMDC expects to get grant aid for collection vehicles, but in the same time studies the possibility to utilize an international fund. The effect on the M/P on solid waste management are not so large, the exception being the final disposal site in regard to financial aspects.

18.3.4 International Donor Agencies related to SWM

The Inter-American Development Bank (IDB) has recently approved a loan to the AMDC of the order of US$40 million. US$500,000 of this amount has been assigned for the improvement of operation and infrastructure of the existing disposal site and for the financing of studies for the location of a new landfill site.

The Pan-American Health Organization (PAHO) is providing technical assistance in the design of waste collection system for the refugees shelters (El Molino and El Trébol). Also PAHO is cooperating in finding a new location for depositing of river sediments as well as some technical assistance for the Cleansing Department.

UNDP is financing the operation of equipment for the cleaning of debris of the zones of middle class areas in Tegucigalpa and Comayaguela, which were not included in the programs of aid by the Central Government.

The Mexican Government dispatched during 2 months a group of soldiers and engineers with heavy equipment. They worked in cleaning activities along the whole flooded areas.

Chapter 19

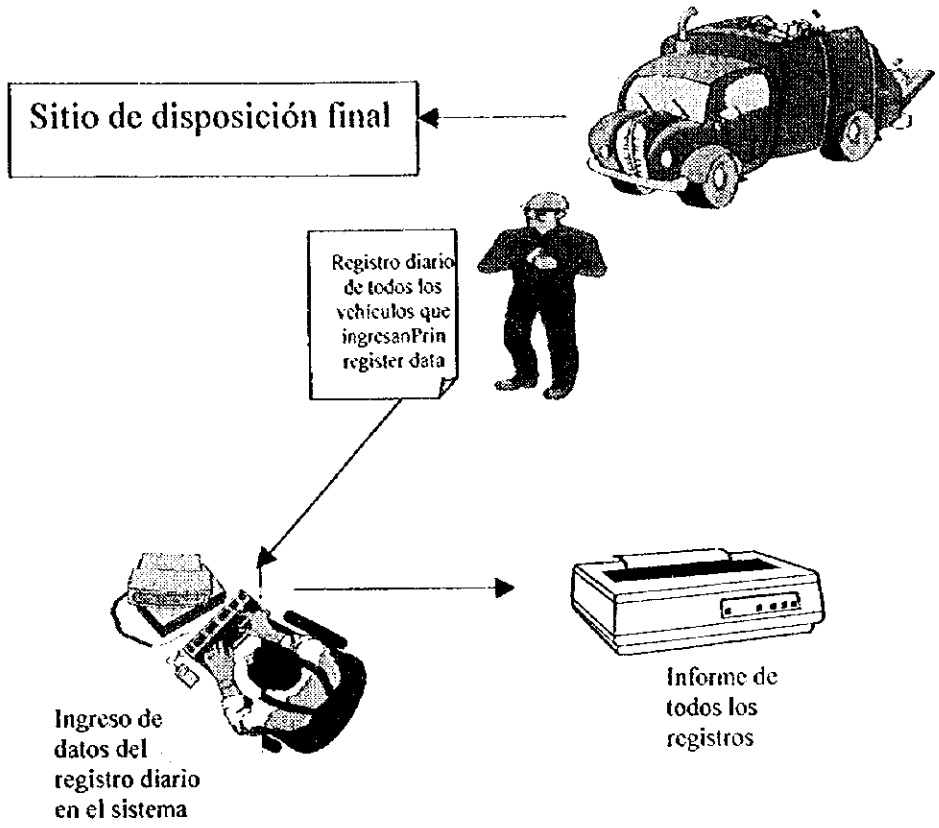
Operation Manual of the SWM Control System for the AMDC

Manual de Usuario

Sistema de Control de AMDC

Contenido

I. Especificaciones del sistema



En la entrada del sitio de disposición final el encargado, registra todos los vehículos que ingresan, en la siguiente planilla.

AMDC - Planilla de Control Diario de Vehículos en el Relleno Sanitario

Fecha								
Placa	**Marca**	**Modelo**	**Entrada**	**Salida**	**Peso**	**Clasif.**	**Zona**	**Resp.**
1			:	:				
2			:	:				
3			:	:				
4			:	:				

1. Se registra el numero de placa o el número de unidad que se utiliza, como identificador del vehículo.
2. La marca del vehículo.
3. El modelo del vehículo.
4. La hora de entrada.

5. La hora de salida.
6. Como en el sitio de disposición final no se cuenta con una bascula, los pesos se estiman de acuerdo la siguiente tabla:

Tipo de vehículo	Toneladas promediadas según el estudio
Fiat (Compactador 13m3)	5.7
Fiat (Volqueta 8m3)	2.9
Hino (Compactador 15m3)	6.4
Nissan (Volqueta 12m3)	3.9
Hino (Volqueta 8m3)	5.3
Mercedez Benz (Volqueta 8m3)	3.2
Hino (Contenedor 12m3)	2.8
Hino (Contenedor 5.5m3)	1.3
Vehículos privados (pequeños)	0.3
Vehículos privados (medianos)	0.7
Vehículos privados (grandes)	1.5

7. Se registran la clasificación del residuo según la siguiente tabla:

Tabla de Clasificación de Residuos

Cod.	Tipo	Cód.	Categoría		Residuo
A	Residuos	A1	Residencial	A101	Area Residencial
		A2		A201	Barrido de calles
				A202	Mercados
				A203	Hoteles y Restaurantes
				A204	Construcción
				A205	
				A206	
				A207	
		A3	Industriales	A301	Contaminantes
				A302	No-contaminantes
		A4	Otros	A401	
B	Tierra	B1	Tierra p/cobertura	B101	Tierra

8. La zona de donde provienen los residuos.
9. Se registra el responsable, quién trae el residuo.

Al final del de la jornada, la planilla se lleva en la oficina central en donde se ingresan todos los registros en la computadora, para su posterior análisis e informe.

Este sistema de control es desarrollado con los siguientes objetivos:

- Para crear una base de datos de todos los vehículos ingresados en el sitio de disposición final.
- Para conocer la cantidad de residuos depositados en el sitio de disposición final.
- Para obtener un análisis, la cual será de gran utilidad en la planificación futura del manejo de residuos sólidos.

II. Sistema

A. Para empezar

- Ejecute el icono AMDC, y luego aparecerá la siguiente pantalla

ESTUDIO SOBRE MANEJO DE RESIDUOS SOLIDOS DEL AREA URBANA DE TEGUCIGALPA DISTRITO CENTRAL DE HONDURAS

EARTHEON

Kokusai Kogyo., LTD.

JICA

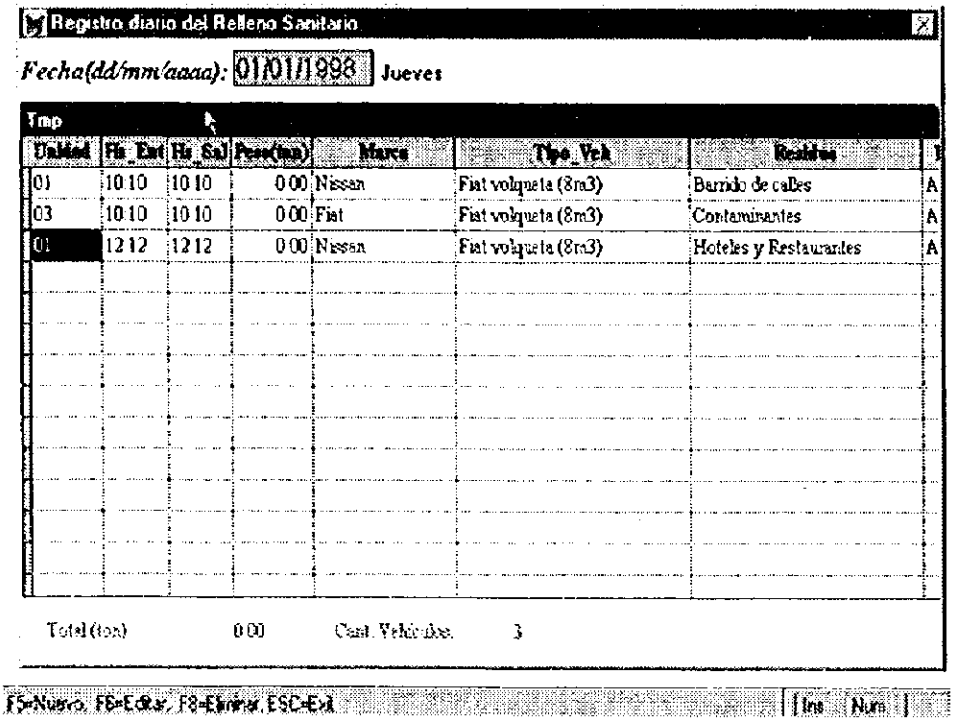
B. *Menú Principal*

Este es el menú principal del sistema, que tienen las diferentes opciones que se detallan a continuación

C. *Registros*

1. Para registrar los datos diarios.

Dentro del opción Registros, seleccione Diarios y aparecerá la siguiente pantalla.

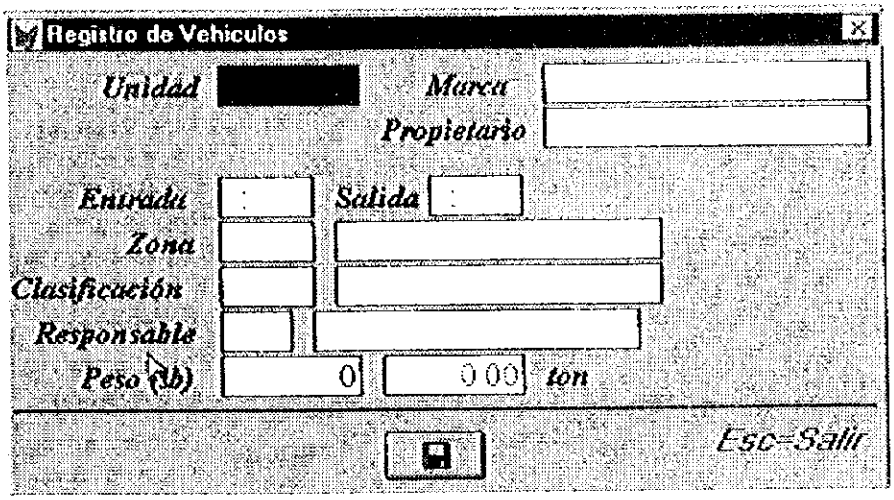


a) Para registrar los datos

Ingrese la fecha del registro, si la fecha de registro es nueva no aparecerá ningún datos, sino aparecerán los datos registrado de esa fecha.

b) Agregar un nuevo registro

Para agregar un nuevo registro presione F5 y aparecerá la siguiente pantalla.



1. Ingrese la el código de la unidad, si el vehículo está registrado, aparecerán los datos correspondiente a esa unidad. Si el vehículo no se encuentra registrado, el sistema le preguntará si desea agregar, verifique bien los datos y luego proceda a confirmar.

> ∀*Nota:* Cuando se agrega una nueva unidad, luego tendrá que ir al menú de **Vehículos**, para actualizar los datos correspondientes a esa unidad

2. Ingrese la hora de entrada al sitio de disposición fi nal.
3. Ingrese la hora de salida del sitio de disposición fi nal.
4. Ingrese la el código de zona de recolección de los residuos o presione μ, para buscar .
5. Ingrese el código de clasificación de residuo o presione μ, para buscar.
6. Ingrese el código del responsable del vehículo o Presione μ, para buscar.
7. Ingrese el peso de neto del residuo.

> ∀*Nota:* El peso solamente se ingresará, de los vehículos que se hayan pesado en alguna bascula. Los que no se pesan se dejan en blanco

8. Presione el botón aceptar.

c) Modificar un registro existente

Para modificar un registro existente, con el cursor elija el registro y luego presione φ y aparecerá una pantalla similar a la de agregar un registro.

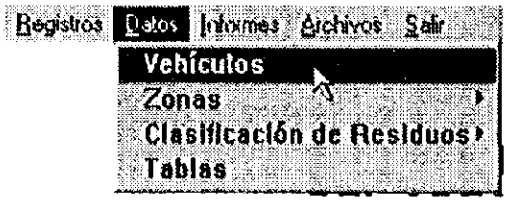
1. Seleccione los datos a modificar y realice las modificaciones correspondientes.
2. Luego de modificar, seleccione el botón aceptar y presione ρ.

d) Eliminar un registro

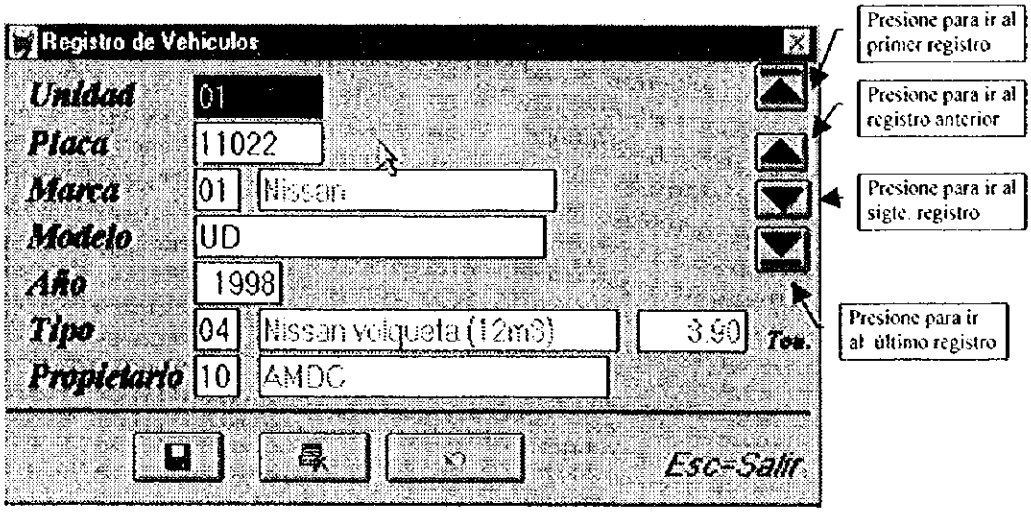
Para eliminar un registro existente, con el cursor elija el registro, verifique bien y asegúrese de que es el registro que desea eliminar, y luego presione ν.

D. Datos

I. *Vehículos*



Dentro de la opción **Datos**, seleccione **Vehículo** y aparecerá la siguiente pantalla.



a) Registro de vehículo nuevo

1. Ingrese código del vehículo nuevo, el sistema verificará si existe y le indicará que es nuevo.
2. Ingrese la placa.
3. Ingrese la marca o presione μ para buscar.
4. Ingrese el modelo que identifique al vehículo.
5. Ingrese el año de fabricación.
6. Ingrese el tipo de vehículo o presione μ buscar.

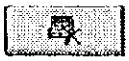
> ∀*Nota:* El tipo de vehículo es imprescindible, porque de acuerdo a esto se calcula el peso de cada vehículo. Verifique que todos los vehículos tengan sus correspondientes tipos, para que todos los informes posteriores sean correctos.

7. Ingrese el código de propietario o responsable del vehículo.
8. Presione el botón guardar, para actualizar los datos del vehículo.

9. Presione el botón cancelar, si desea cancelar y no modificar nada.

b) **Eliminar el registro de un vehículo**

1. Ingrese código del vehículo que desea eliminar, si es que está registrado aparecerán los datos correspondientes.
2. Seleccione el botón eliminar y presione ρ

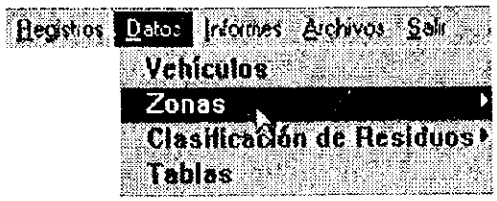


> ∀*Nota:* No se pueden eliminar los vehículos que se encuentran registrado y tienen algún registro de entrada en el sitio de disposición final.

c) **Consultas**

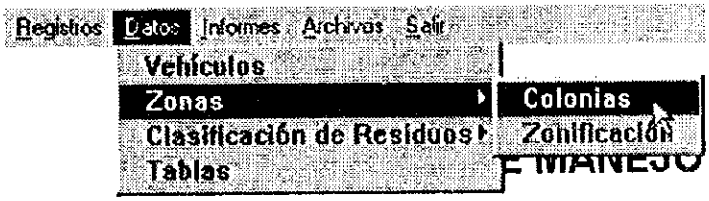
1. Presione los botones de consultas que se encuentran en el lado derecho de la pantalla.

2. ***Zonas***

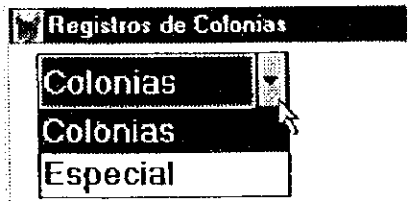


a) **Colonias**

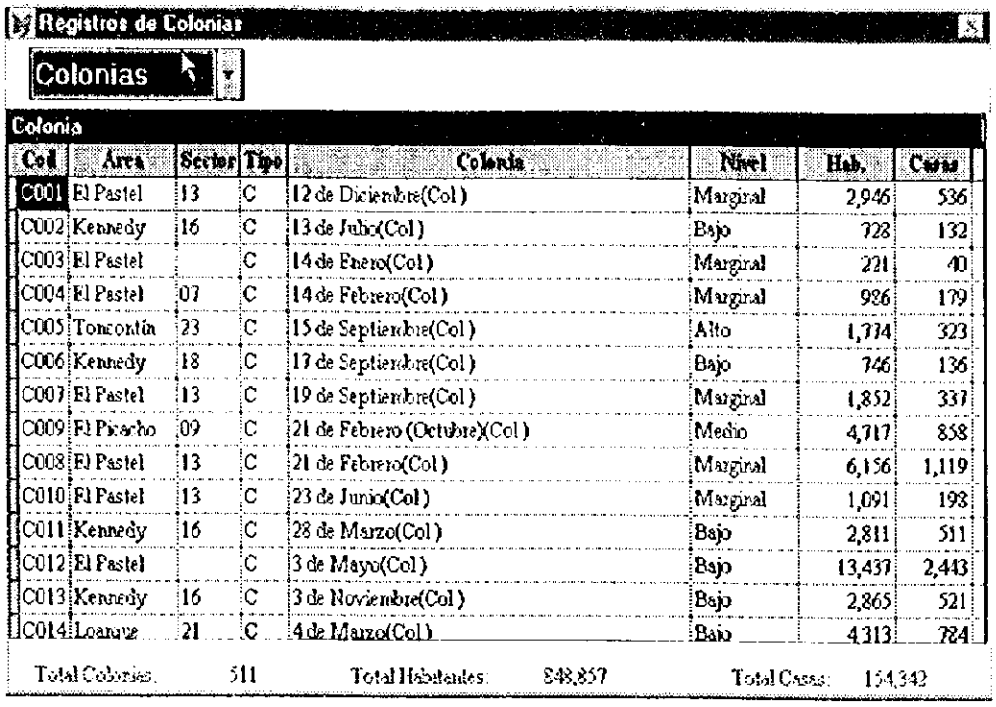
Dentro de esta opción se definen las colonias y lugares especiales que integran las zonas de recolección.



Dentro de la opción zona elija colonias y aparecerá la siguiente pantalla.



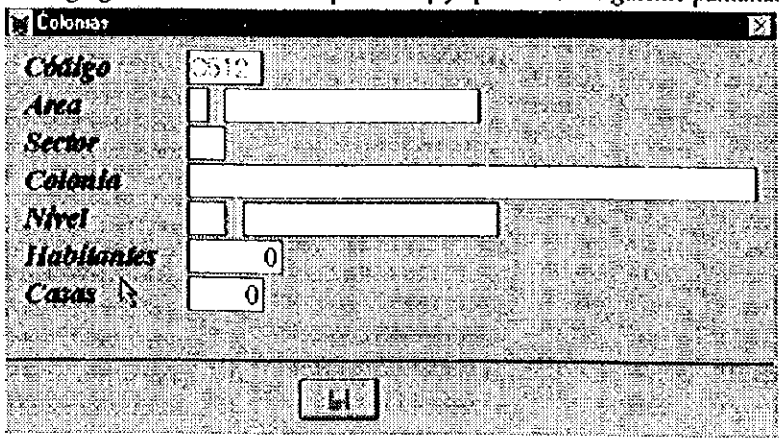
Para definir las colonias , elija la opción Colonias y luego aparecerá la siguiente pantalla.



Col	Area	Sector	Tipo	Colonia	Nivel	Hab.	Casas
C001	El Pastel	13	C	12 de Diciembre(Col)	Marginal	2,946	536
C002	Kennedy	16	C	13 de Julio(Col)	Bajo	728	132
C003	El Pastel		C	14 de Enero(Col)	Marginal	221	40
C004	El Pastel	07	C	14 de Febrero(Col)	Marginal	986	179
C005	Toncontín	23	C	15 de Septiembre(Col)	Alto	1,774	323
C006	Kennedy	18	C	17 de Septiembre(Col)	Bajo	746	136
C007	El Pastel	13	C	19 de Septiembre(Col)	Marginal	1,852	337
C009	El Picacho	09	C	21 de Febrero (Octubre)(Col)	Medio	4,717	858
C008	El Pastel	13	C	21 de Febrero(Col)	Marginal	6,156	1,119
C010	El Pastel	13	C	23 de Junio(Col)	Marginal	1,091	198
C011	Kennedy	16	C	28 de Marzo(Col)	Bajo	2,811	511
C012	El Pastel		C	3 de Mayo(Col)	Bajo	13,437	2,443
C013	Kennedy	16	C	3 de Noviembre(Col)	Bajo	2,865	521
C014	Loarque	21	C	4 de Marzo(Col)	Bajo	4313	784

Total Colonias: 511 Total Habitantes: 848,857 Total Casas: 154,342

1. Para agregar una nueva colonia presione φ y aparecerá la siguiente pantalla.



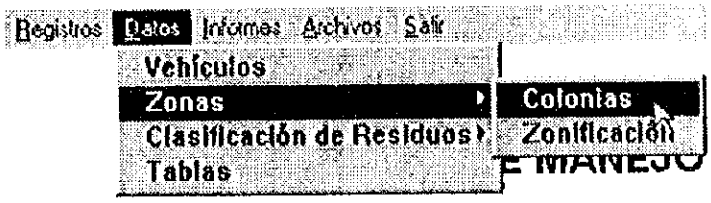
- El código de colonia se generará automaticamente
- Ingrese el código de área, que comprende la colonia o presione μ para buscar.
- Ingrese el sector en que se encuentra la colonia.
- Ingrese el código de nivel de vida de la colonia o presione μ para buscar.
- Ingrese la cantidad de habitantes de la colonia.
- Ingrese la cantidad de casas de la colonia.
- Seleccione el botón guardar y presione ρ

2. Para modificar los datos de las colonias presione κ y aparecerá una pantalla similar al de agregar.
   - Dentro de la pantalla realice todos los cambios correspondientes
   - Seleccione el botón guardar y presione ρ

3. Para eliminar los datos de las colonias, seleccione la colonia que desea eliminar y luego presione ν.

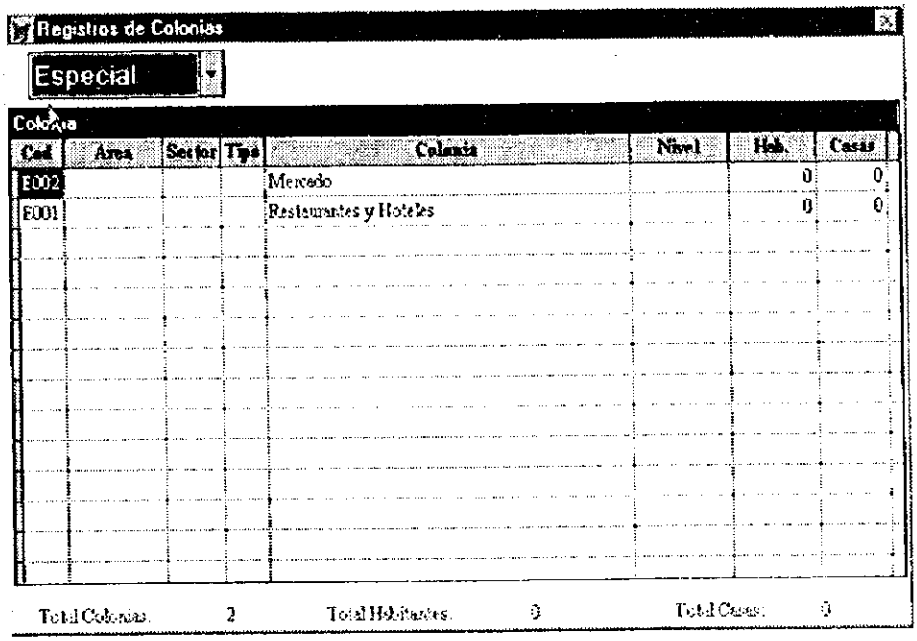
b) **Zonas Especiales**

Dentro de esta opción se definen las colonias y lugares especiales que integran las zonas de recolección.

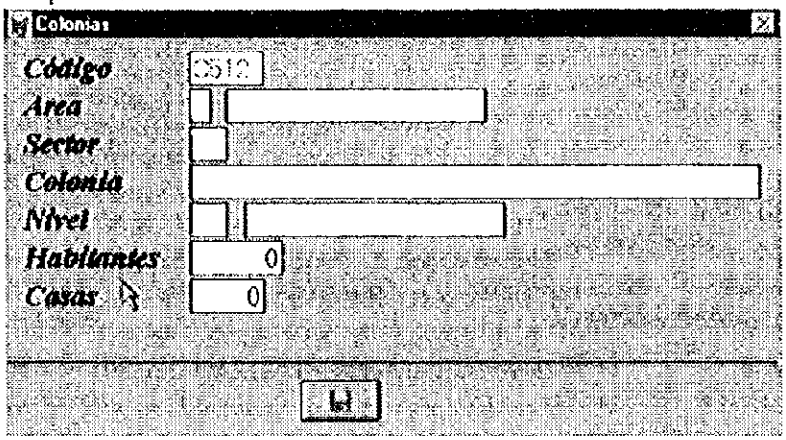


Dentro de la opción zona elija colonias y aparecerá la siguiente pantalla.

Para definir los lugares especiales, elija **Especial** y luego aparecerá la siguiente pantalla.



1. Para agregar un nuevo lugar especial presione φ y aparecerá la siguiente pantalla.



- Los código de los lugares especiales se generará automáticamente
- Ingrese el código de área, que comprende el lugar o presione μ para buscar.
- Ingrese el sector en que se encuentra.
- Ingrese el código de nivel de vida del lugar o presione μ para buscar.
- Ingrese la cantidad de habitantes.
- Ingrese la cantidad de casas.
- Seleccione el botón guardar y presione ρ

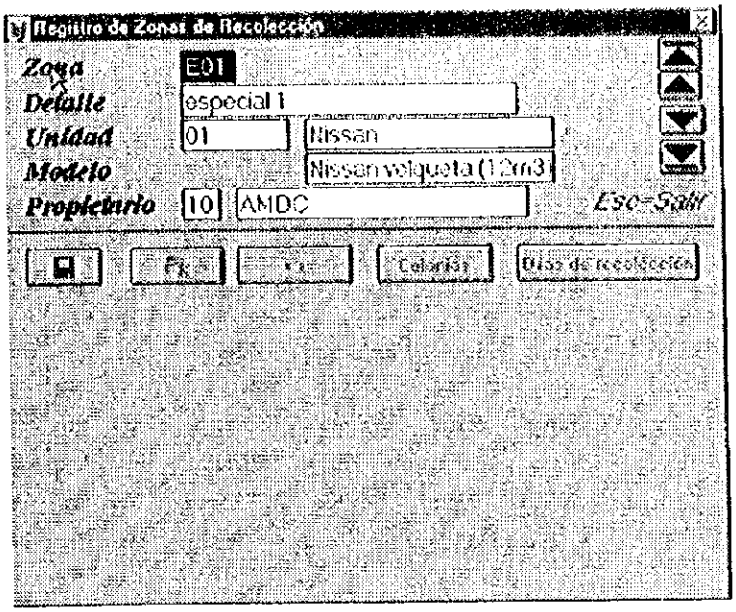
2. Para modificar los datos de los lugares especiales presione κ y aparecerá una pantalla similar al de agregar.
   - Dentro de la pantalla realice todos los cambios correspondientes
   - Seleccione el botón guardar y presione ρ

3. Para eliminar los datos de las colonias, seleccione la colonia que desea eliminar y luego presione ν.

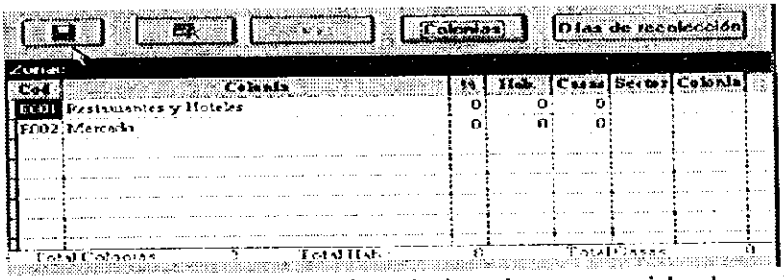
c) Zonificación

Dentro de esta opción se definen las zona de recolección.

Dentro de la opción zona elija **Zonificación** y aparecerá la siguiente pantalla.

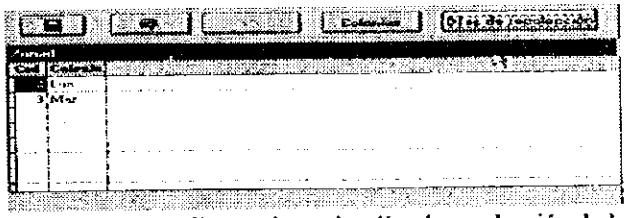


1. Para agregar una nueva zona de recolección, ingrese el código de la zona.
2. Ingrese el detalle de la zona.
3. Ingrese la unidad encargada de recolección.
4. Ingrese el responsable de la recolección de la zona.
5. Seleccione el botón guardar y presione ρ para guardar los datos de la zona.
6. Seleccione el botón colonias y presione ρ y aparecerá la siguiente pantalla.



- En esta pantalla se asignan las colonias y lugares especiales de recolección que comprende la zona definida.
- Para agregar una nueva zona o lugar especial de recolección presione φ, y aparecerá una lista de las zonas o de los lugares especiales de recolección.
- Seleccione uno y presione ρ.
- Ingrese el porcentaje de cobertura de la colonia o del lugar especial de recolección.
- Presione ε para salir.

7. Seleccione el botón días de recolección y aparecerá la siguiente pantalla.



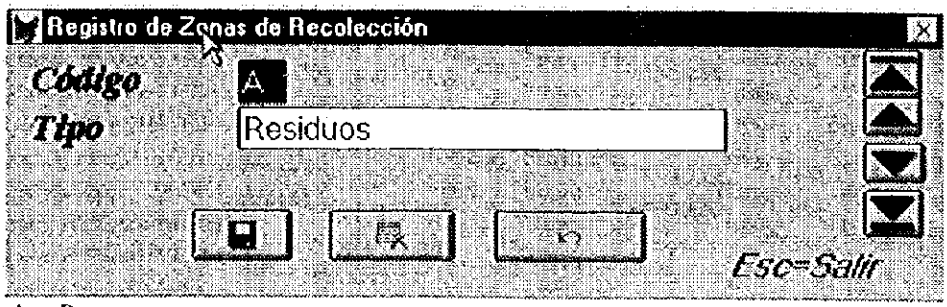
- En esta pantalla se asignan los días de recolección de las distintas zonas.
- Para agregar un nuevo día de recolección presione φ, y aparecerá una lista de los días.
- Seleccione el día correspondiente y presione ρ.

3. Clasificación de residuos

Esta opción le permite definir la tabla de clasificación de residuos. Siga los siguientes pasos

a) Tipos

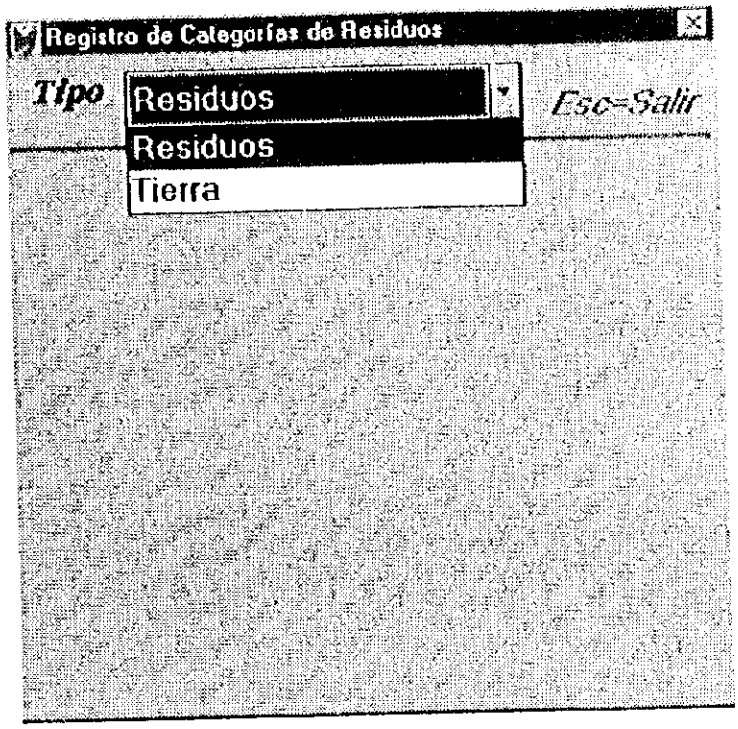
Primeramente defina los tipos, para la cual dentro de la opción **Clasificación de Residuos** , elija la opción **Tipos** y aparecerá la siguiente pantalla.



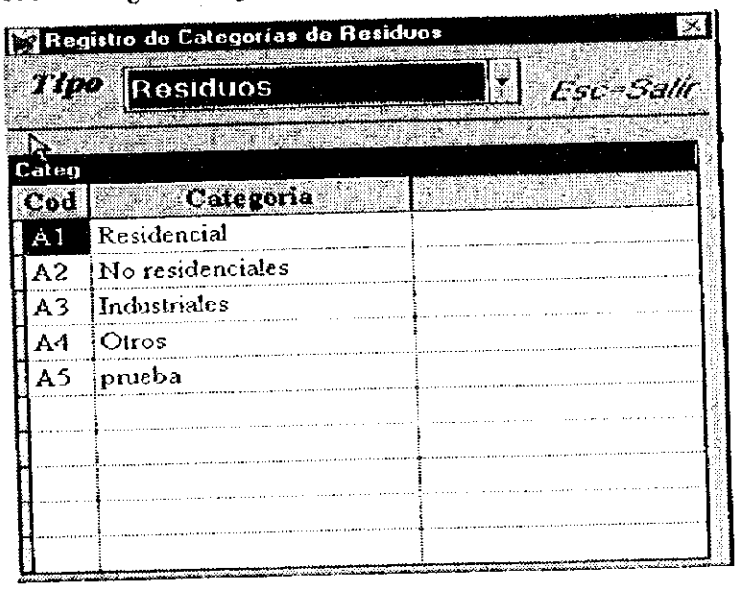
1. Para agregar
   - Ingrese el código de tipo, si el código no existe le aparecerá un mensaje que es nuevo.
   - Ingrese el detalle del tipo.
   - Seleccione el botón guardar y presione ρ para actualizar los datos o seleccione el botón cancelar, para cancelar.
2. Para eliminar
   - Ingrese el código de tipo, que desea eliminar, si el código existe le aparecerá los detalles del tipo.
   - Seleccione el botón eliminar y presione ρ.
3. Para consultas
   - Elija los botones de consulta que aparecen en la parte derecha de la pantalla.

b) Categorías

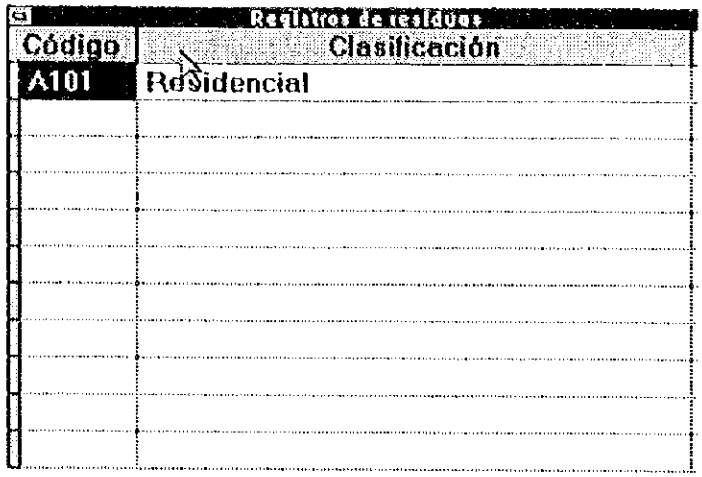
Luego defina las categorías, para la cual dentro de la opción **Clasificación de Residuos** , elija la opción **Categorías** y aparecerá la siguiente pantalla.



1. Elija le tipo del cual se van a definir las categorías.
2. Si existen algunas categorías definidas aparecerán en la siguiente pantalla.



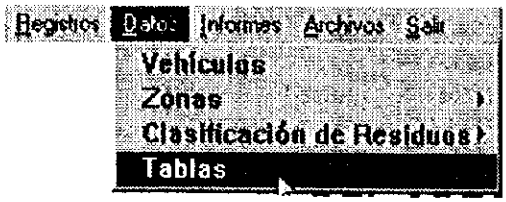
3. Para agregar nueva categoría
   - Presione φ y le habilitará una nueva fila para ingresar los detalles correspondientes de la categoría.
   - El código nuevo se generará automáticamente.
4. Para eliminar una categoría.
   - Seleccione la categoría que desea eliminar y presione v
5. Para agregar una sub-división de la categoría presione ρ y le aparecerá la siguiente pantalla.



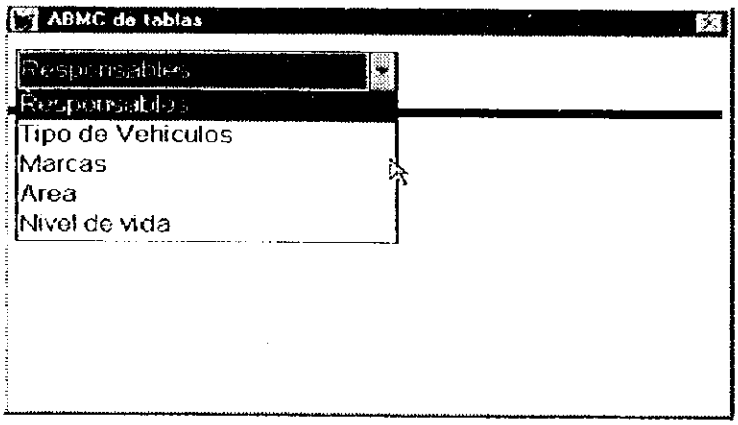
- Para agregar una sub-división presione φ, y el código se generará automáticamente y luego le habilitará para cargar los detalles.
- Presione ε, para volver a la pantalla anterior.

6. Para imprimir la tabla de clasificación de residuos presione 0.

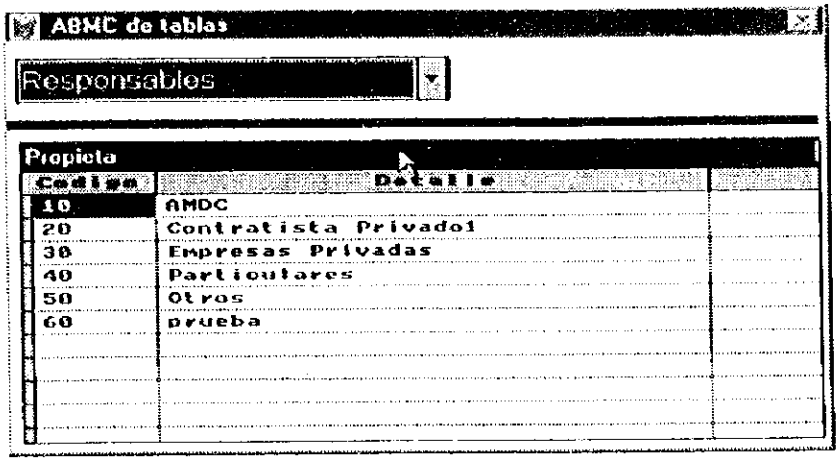
4. Tablas



Para actualizar todas las tablas utilizadas por el sistema, dentro del menú **Datos**, seleccione la opción **Tablas** y le aparecerá la siguiente pantalla.



Seleccione la tabla deseada y presione ρ. Y le aparecerá una pantalla similar a la siguiente de acuerdo a la tabla elegida. Todos los procedimiento de manejo de los datos de las tablas son similares.



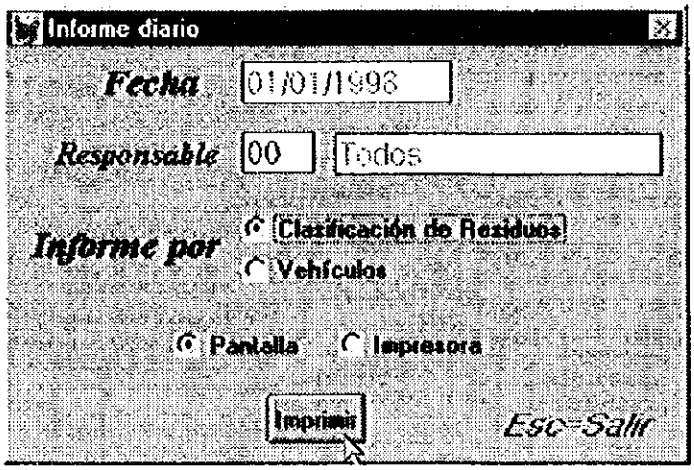
1. Para agregar.
   - Presione φ y le aparecerá una ventana en donde debe ingresar el código.
   - Ingrese el detalle y presione ρ.
2. Para Eliminar
   - Seleccione la fila que desea eliminar y luego presione v.Ingrese el detalle y presione ρ.
3. Para imprimir presione 0

E. *Informes*

1. Registros diarios

a) Diarios

Para obtener informe de los registros diarios de los vehículos que ingresan al sitio de disposición final , dentro del menú **Informes**, seleccione la opción **Diarios** y le aparecerá la siguiente pantalla.

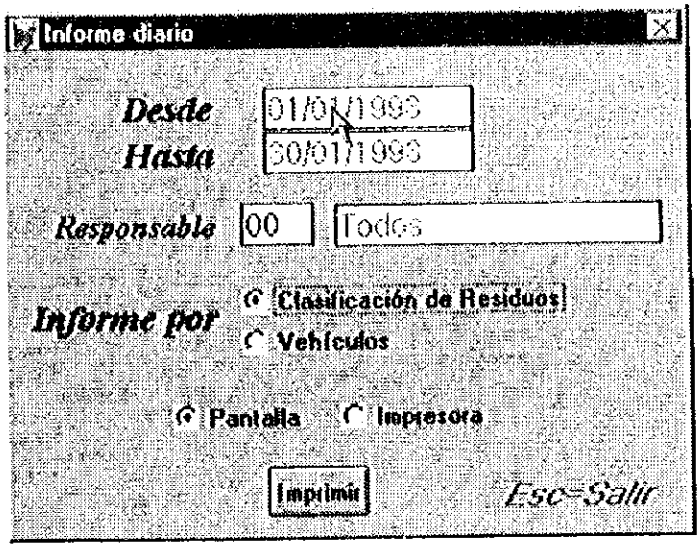


1. Ingrese la fecha del informe
2. Ingrese el código de responsable, si desea el informe de un solo responsable o "00" para incluir todos los responsables. Si no se acuerda del código del responsable presione μ para buscar.
3. Elija el tipo de informe.
4. Elija el dispositivo de salida, si desea imprimir en la impresora, prepare primeramente la impresora y luego elija el botón imprimir y presione ρ.

> ∀*Nota:* En esta opción solo se pueden obtener informe de un solo día.

b) Fechas

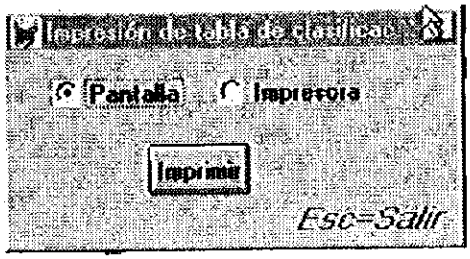
Para obtener informe de los registros diarios de varios días, dentro del menú **Informes**, seleccione la opción **Fechas** y le aparecerá la siguiente pantalla.



1. Ingrese la fecha inicial.
2. Ingrese la fecha final.
3. Ingrese el código de responsable, si desea el informe de un solo responsable o "00" para incluir todos los responsables. Si no se acuerda del código del responsable presione µ para buscar.
4. Elija el tipo de informe.
5. Elija el dispositivo de salida, si desea imprimir en la impresora, prepare primeramente la impresora y luego elija el botón imprimir y presione ρ.

2. *Vehículos*

Para obtener informe de todos los vehículos registrados, dentro del menú **Informes**, seleccione la opción **Vehículos** y le aparecerá la siguiente pantalla.



Elija el dispositivo de salida, si desea imprimir en la impresora, prepare primeramente la impresora y luego elija el botón imprimir y presione ρ.

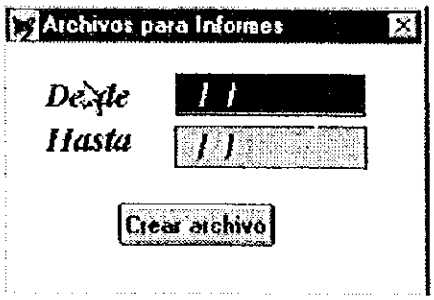
F. Archivos

1. Registros

Esta opción del sistema le permite transportar la base datos de los registros diarios a un formato de archivo de Microsoft Excel. El archivo creado, se puede abrir con la planilla electrónica y es posible la manipulación de los datos, y crear informes acorde a sus necesidades cotidianas.

a) Crear archivos de los registros diarios

Dentro del menú **Archivos**, seleccione la opción **Registros** y le aparecerá la siguiente pantalla.



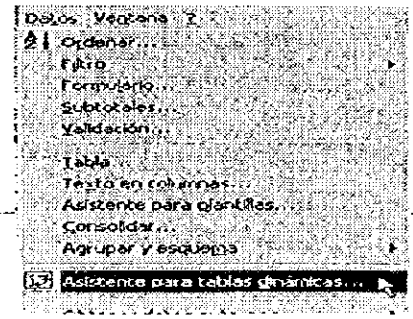
1. Ingrese la fecha inicial.
2. Ingrese la fecha final.
3. Seleccione el botón **Crear archivo** y presione ρ
4. Se creará un archivo con formato de Excel en el siguiente directorio: C:\SYS\AMDC\FILE\datos.xls

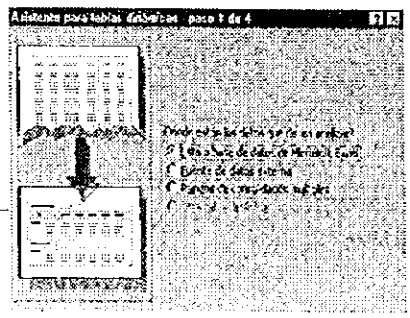
A continuación se le ilustrará unos ejemplos de Microsoft Excel.

- Primeramente abra el archivo datos.xls

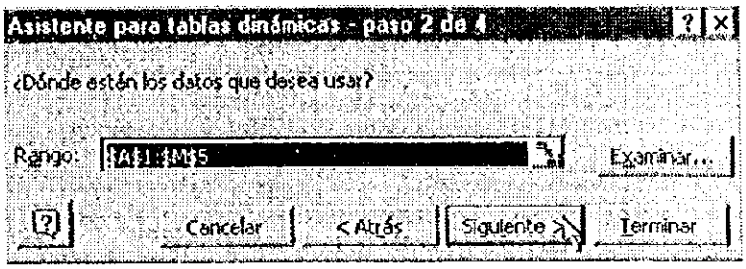
	A	B	C	D	E	F	G	H
1	unidad	rd_cod	marca	tipou	residuo	clasif	zona	resp
2	01	3	Nissan	Fiat volqueta (8m3)	Residuos	Hoteles y Restaurantes	R01	AMDC
3	01	1	Nissan	Fiat volqueta (8m3)	Residuos	Barrido de calles	R01	AMDC
4	03	2	Fiat	Fiat volqueta (8m3)	Residuos	Contaminantes	R01	AMDC
5	01	4	Nissan	Fiat volqueta (8m3)	Residuos	Barrido de calles	R01	Empresas Privadas
6								

- Elija el asistente de tabla dinámica, en el siguiente menú

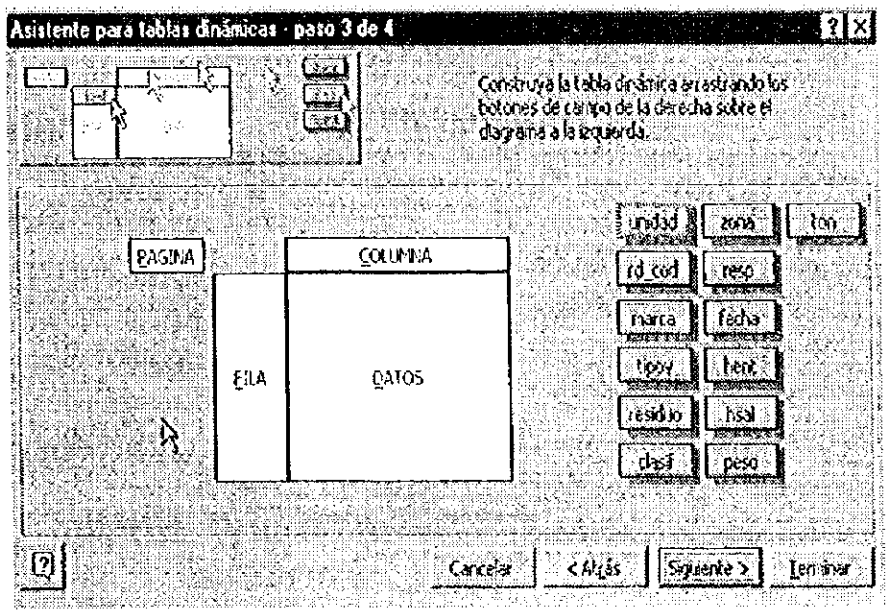




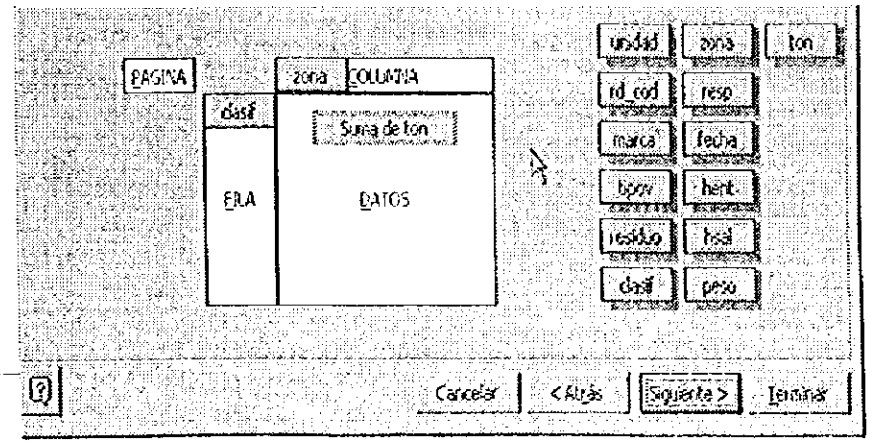
- Siga los pasos siguientes



- Dentro de la siguiente pantalla elija los datos que desea incluir en el informe



- Por ejemplo si se elige por fila la clasificación y por columna la zona y como datos la suma de toneladas



- Se obtiene el siguiente informe, para más detalle véase en los manuales de usuarios de Microsoft Excel o en el Help de dicha aplicación.

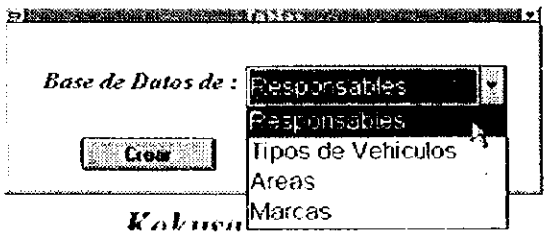
	A	B	C	D
1	Suma de ton	zona		
2	clasif	R01	Total general	
3	Barrido de calles	7.44	7.44	
4	Contaminantes	[illegible]	2.9	
5	Hoteles y Restaurantes	2.9	2.9	
6	Total general	13.24	13.24	
7				
8				

2. Tablas

Esta opción del sistema le permite transportar la base datos de las tablas utilizadas por el sistema a un formato de archivo de Microsoft Excel. El archivo creado, se puede abrir con la planilla electrónica y es posible la manipulación de los datos, y crear informes acorde a sus necesidades cotidianas.

a) Crear archivos de las tablas

Dentro del menú **Archivos**, seleccione la opción **Tablas** y le aparecerá la siguiente pantalla.



Elija la tabla deseada y seleccione el botón Crear y presione p

III. Bases de datos del Sistema

A. *Registro diario de los vehículos*

Nombre	REGDIA.DBF		
Detalle	Registro de todos los vehículos que ingresan		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
RD_COD	Numeric	7	Código
RD_UNIDAD	Character	7	Unida
RD_TIPO	Character	1	Código de tipo de residuo
RD_CODCLA	Character	4	Código de clasificación
RD_CODZONA	Character	3	Código de zona
RD_CODRESP	Character	2	Código de responsable
RD_FECHA	Date	8	Fecha de registro
RD_HSENT	Character	5	Hora de entrada
RD_HSSAL	Character	5	Hora de salida
RD_PESO	Numeric	5	Peso real si es que se pesa
RD_TON	Numeric	4,2	Peso estimado según el estudio

B. *Vehiculos*

Nombre	VEHICULO.DBF		
Detalle	Registro de todos los vehículos		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
V_UNIDAD	Character	7	Código de la unidad
V_PLACA	Character	7	Nro. De placa
V_MARCA	Character	2	Código de marca
V_MODELO	Character	15	
V_TIPO	Character	2	Código de tipo de vehículo
V_AÑO	Numeric	4	
V_PROP	Character	2	Código de responsable
V_PESO	Numeric	2	Peso tara

C. *Marca*

Nombre	MARCADBF		
Detalle	Registro de todos las marcas de vehículos		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
M_COD	Character	2	Código
M_DETALLE	Character	15	Detalle de la marca

D. *Tipo de Vehículos*

Nombre	TIPOV.DBF		
Detalle	Registro de todos los tipos de vehículos		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
TV_COD	Character	2	Código
TV_DETALLE	Character	25	Detalle
TV_PESO	Character	4,2	Peso promedio según estudio

E. Responsables

Nombre	PROPIETA.DBF		
Detalle	Registro de todos los responsables		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
PR_COD	Character	2	Código
PR_DETALLE	Character	25	Detalle

F. Zona de Recolección

Nombre	ZONA.DBF		
Detalle	Registro de todas las zonas de recolección		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
ZO_COD	Character	3	Código
ZO_DETALLE	Character	20	Detalle
ZO_UNIDAD	Character	7	Unidad de recolección
ZO_RESP	Character	2	Código de responsable

G. Residuo

Nombre	RESIDUO.DBF		
Detalle	Registro de todos tipos de residuo		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
RE_COD	Character	4	Código
RE_DETALLE	Character	25	Detalle

H. Categoría de Residuo

Nombre	CATEG.DBF		
Detalle	Registro de todas las categorías de residuo		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
CA_COD	Character	2	Código
CA_DETALLE	Character	20	Detalle

I. Area

Nombre	AREA.DBF		
Detalle	Registro de todas las áreas de la ciudad		
Campos			
Nomnre	*Tipo*	*Ext.*	*Descripción*
AR_COD	Character	1	Código
AR_DETALLE	Character	10	Detalle

J. Nivel de vida

Nombre	NIVEL.DBF

Detalle	Registro de todos los niveles de vida		
Campos			
Nombre	*Tipo*	*Ext.*	*Descripción*
NI_COD	Character	1	Código
NI_DETALLE	Character	10	Detalle

IV. Recomendaciones Generales

- Como el sistema es implementado por primera vez en la AMDC, de aquí en adelante se tendrán que ir ajustándose a las exigencias diarias. Pero manejar una base de dato de las generaciones de los residuos es fundamental para la planificación futura de manejo de residuos sólidos.
- En la actualidad no se cuenta con una báscula y en estas condiciones es muy difícil obtener datos certeros de la generación. Tiene que ser una prioridad del departamento adquirir una báscula para ir obteniendo datos mas fiables.
- Se tendrán que ir ajustando las rutas de recolección, haciendo los estudios de tiempo y movimiento.