SW-57c

USER'S MANUAL

OLMS

A COLLECTION
INFORMATION
FOR SOLID MANAGEMENT

VOLUME ONE

USER'S MANUAL FOR

COLMIS

A COLLECTION MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE MANAGEMENT

VOLUME ONE

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COLMIS User's Manual Volume Two, primarily for the systems analyst and data processor, contains flow charts, a computer program, input information, and a sample problem. It is now in preparation and when available, may be obtained from the Office of Solid Waste Management Programs, U.S. Environmental Protection Agency, Washington, D.C. 20460

An environmental protection publication in the solid waste management series (SW-57c)

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CHAPTER I

COLMIS

COLMIS, COLlection Management Information System, is a computerized tool for environmental improvement and gathering information on residential solid waste collection activities. It provides definitive information on the operational aspects of collection and the costs involved in providing this service. The system was designed to accomplish two objectives: to provide managers at all levels with a tool to facilitate the decision-making process, and to provide the necessary information for detailed evaluation of the needs for and effects of change in operational procedures.

Providing information at every level in the organization enables each manager to evaluate his performance by his own standards and in comparison to the performance of other managers. In examining his operation he is able to review the activities of all his subordinates and pinpoint the need for improvements. The COLMIS reports also serve as a creditable record of operations and costs.

As a planning tool, the COLMIS reports provide the specific data needed to gauge a "fair day's work" for each crew, truck and crew requirements for the entire city, and boundaries for daily routes and districts. The reports can aid in determining the useful life for equipment and thus help in planning a capital replacement program. They can also be instrumental in studying types of equipment, crew size, and management structure.

Input Requirements

There are two kinds of input data required for the operation of COLMIS. One is background or general information which is placed in the computer program. It is collected at the time the system is implemented. Included are items such as vehicle costs and useful life, salaries and fringe benefits. This type of data is relatively stable and is reentered into the system only if the values used are changed.

The other type of input is daily operational information. Each day, each driver of a collection vehicle completes a simple form which outlines his crew's activities for the day. The form was designed to make this job as easy as possible and to take the driver only a few minutes to complete. It is necessary,

however, that the drivers be able to read, write, and tell time. The data provided, including times and mileage when specific actions were begun and ended, make it possible to set forth in report form an accurate accounting of how the collection operation functions on a day-by-day basis. Daily activities to be monitored encompass traveling from the motor pool to the route, collecting solid waste from the residences, transporting the waste to a disposal point, and returning to the motor pool.

Data Processing

The COLMIS computer program, which converts the input data to management reports, is of relatively simple design. It is written in the Fortran IV language and will operate on computers of varying size and configuration. The main program and its subroutines as distributed require a minimum of 102k core storage. Additional core will be required for the system operating software. As the number of routes and vehicles increases from that of the basic test problem, the required core (102k) also increases. However, the program can be adapted to smaller equipment. Weekly computer operating time for a city having 30 routes would probably be between 20 and 45 minutes, but would depend on the computer used and its capabilities.

Management Reports

COLMIS reports are generated on a weekly and monthly basis. Weekly reports are geared toward direction and control of the collection operation. There are four parts to each set of weekly reports: route information dealing with times, miles and weights; collection information dealing with characteristics of the area collected and parameters of crew performance; collection cost information showing a breakdown of the cost of collection activities; and a collection system operation summary providing a capsulized picture of the most significant items from the other three sections. One set showing the day by day performance of each crew is aimed toward the immediate supervisor of the collection crews. Reports for middle management give only a summarization of weekly activities for each crew. Top management's reports contain summary information on the total operation with a breakdown by organizational units (i.e., assistant superintendents, supervisors, foremen), if applicable. In addition to these, management analysis reports comparatively rate the performance of the crews or organizational units on ten performance indicators such as weight collected and homes served. These are most useful to route foremen and middle management.

Monthly reports are prepared in a four-part format identical to the weekly reports; however, information is summarized by day of the week for each crew. This makes it possible to compare the operation on Monday to that on Tuesday, and it makes comparison of all crews on each day of the week feasible. These reports can be very helpful in evaluating the balance of work loads throughout the week. Middle management receives a summarization of the whole month for each crew. And top management is provided with an overall summarization with optional breakdown by organizational unit. Management analysis reports are also generated. Monthly reports serve a dual purpose. They complement the weekly reports when used as an operational management tool, and they provide a well organized data base for planning collection system modifications and improvements.

It is the purpose of COLMIS to provide a systematic base of information from which all levels of management can plan and operate an effective and efficient solid waste collection system.

CHAPTER II

OPERATION OF COLMIS

Use of the Management Reports

COLMIS was designed to be an effective information tool for managers at all levels in the solid waste collection system. The benefits derived from COLMIS depend directly on each manager. As in all administrative environments, communication among all members of the solid waste management team is important. Policy decisions must be effectively implemented, with top management taking the initiative and the rest of the organization cooperating in the effort. The ability to transmit information from the operational levels to the top is critical. Equally important is the capability of each manager to evaluate his own performance and those of his subordinates. Each should be able to confer with other members of his level in the organization, and with a common base of information, to give and receive assistance in improving all parts of the system.

COLMIS alleviates some communication problems by providing uniform information to each manager with the degree of detail most useful to him. Each is provided enough information to enable him to analyze his own performance. The uniformity of reporting makes it possible to compare the functioning of one part of the organization to all others on the same basis. Providing the reports to all levels of management will not only transmit information up and down the chain of command, but will allow the entire organization to monitor its progress in effecting new policies and to recognize any need for additional change.

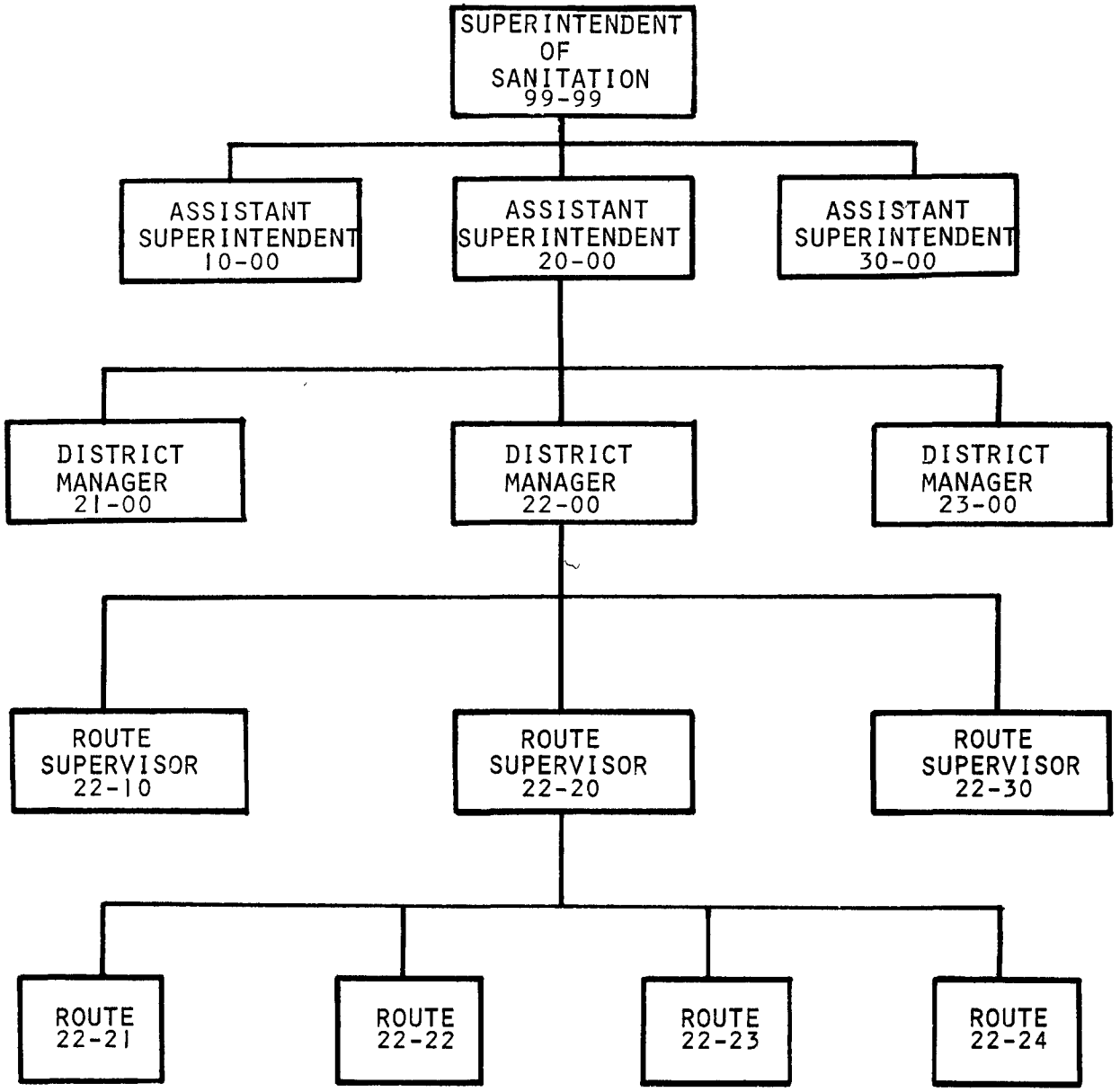
Built into COLMIS is a great degree of flexibility so that it can be adapted to almost any organizational structure. The closer COLMIS does reflect reality, the more useful it will be. Summarization within the reports will then accurately reflect the actual performance of each unit of the organization. Options are provided so that summaries of information are available for each level of management and so that only the reports most useful to each manager need be produced.

Route Numbering Systems. Each route and each level of management needs to be identified in a four-digit numerical scheme for purposes of the COLMIS reports. A maximum of five levels can be reflected. One level is represented by each of the four digits and the fifth level of top management is assumed (Figure 1). In this sample organization, 1X-XX represents an assistant superintendent, X1-XX a route supervisor, and XX-X1

Figure 1

COLLECTION SYSTEM ORGANIZATION

(LARGE CITY)



a route. The superintendent is represented by the number 99-99.

Using the example of route number 21-34:

2 represents the area under the second assistant superintendent.

1 represents the first district of the second area.

3 represents the third route supervisor (foreman) of the first district of the second area.

4 represents the fourth route under the third route supervisor (foreman) of the first district of the second area.

Activities under the numbers:

21-34 represents the activities of the fourth route under the third route supervisor (foreman) of the first district of the second area.

21-30 represents the total activities of all routes under the third route supervisor (foreman) of the first district of the second area.

21-00 represents the total activities under the first district manager of the second area.

20-00 represents the total activities under the second assistant superintendent.

99-99 represents the total of all activities under the superintendent of sanitation.

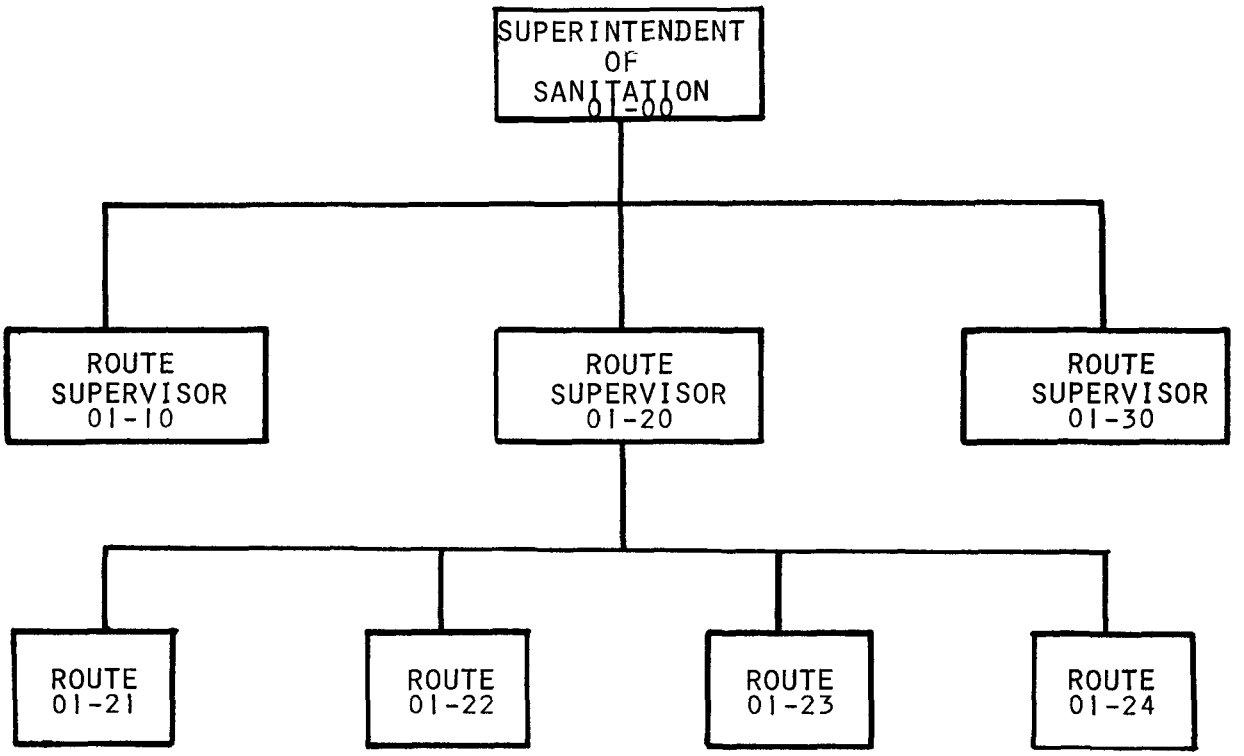
The COLMIS numbering system can easily be simplified to represent medium-size systems (Figure 2). A smaller city with only seven routes could use a numbering system as simple as 00-11 through 00-17. Any system that is representative of the organization can be used.

Each digit affects the levels of summarization on the COLMIS reports. The third digit gives a route supervisor summary at the bottom of the detail reports, the data in the second level of reports, and a summary on the management analysis information reports. The first digit gives an area summary on the management analysis report. If any of these digits is zero, the summarization is not printed. The fourth digit must be non-

Figure 2

COLLECTION SYSTEM ORGANIZATION

(MEDIUM CITY)



zero for every route.

If several communities join together in a regional organization, the route numbering can be structured so that the digits usually designating area and district would represent the communities. An overall average for the region would be provided under the 99-99 identifying number.

Activity aspects of the collection operations can be incorporated in the route numbering scheme as easily as the organizational aspects. The case of every-other-week collection could be represented by using a set of numbers beginning with 1 to designate activities of the first week of the collection cycle and a set of numbers beginning with 2 to designate the second week. These two weeks of activity can be combined in one set of COLMIS reports under the number 99-99 to provide total results for the complete collection cycle.

If separate collections are made for trash and garbage, a similar procedure can be used. For example, all garbage collection routes could have a number beginning with 1 and all trash collection routes could have numbers beginning with 2. This will provide for a breakdown of the total operation to segregate these two distinct activities while still retaining an overall summary of the entire collection system. A similar system distinction can be made between regular and bulky collection system.

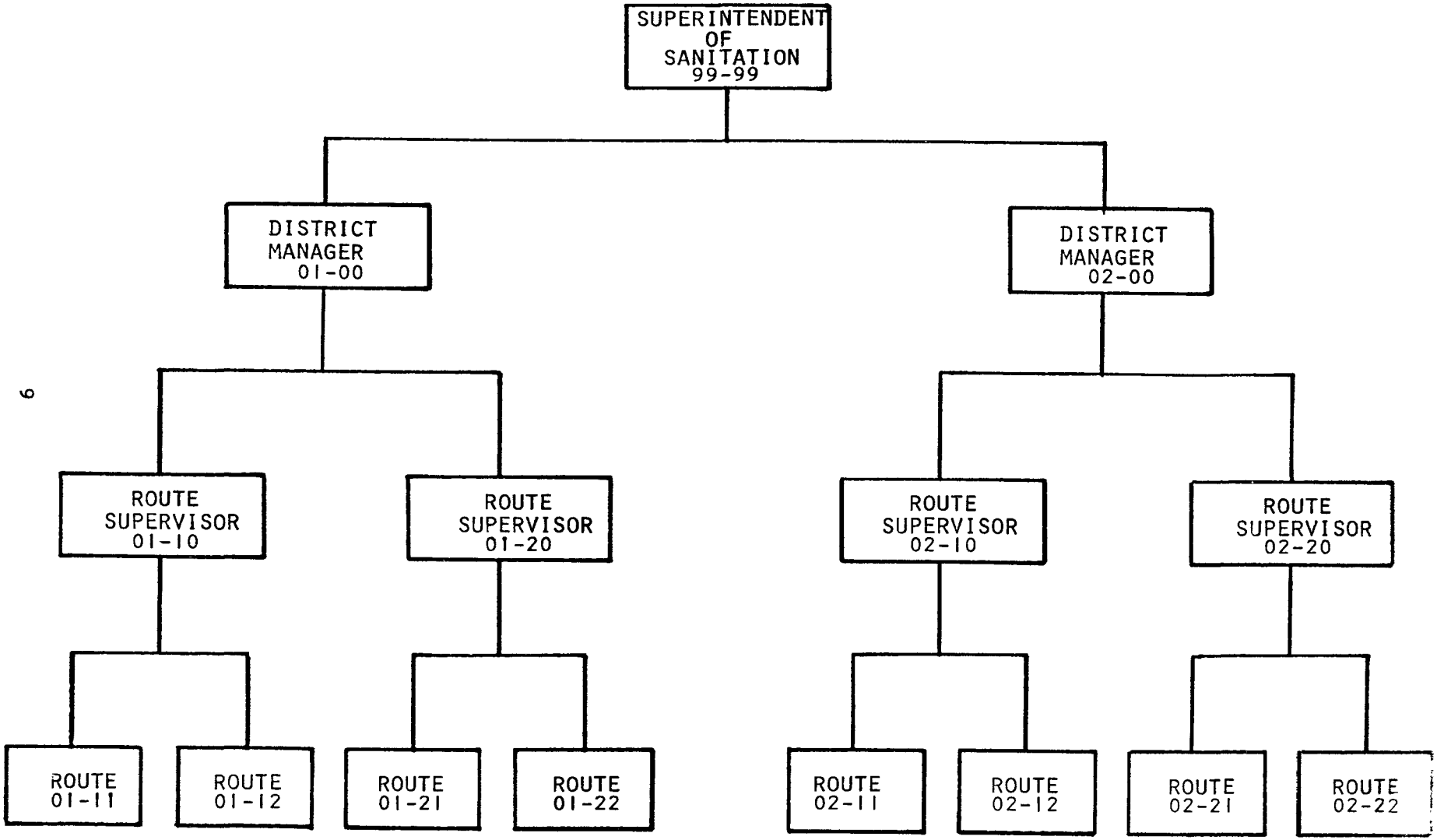
In the case of a system where two different types of systems are servicing the same set of homes, various discrepancies will occur in the city averages. For example, if one system of garbage and trash collection, twice a week, is defined under the 10-00 series of route numbers and a one-day trash collection is defined under the 20-00 series, all information summarized within each system will be accurate for that specific function. On citywide figures, however, the two systems will be averaged instead of added together. For overall system time and cost summarization, this is as it should be. But on a per home basis, it is incorrect. For instance if garbage and trash collection costs 20¢ per home per week and dry trash pickup costs 10¢, the true cost per home per week is 30¢. The COLMIS reports would report 15¢, the result of averaging. This will be true of all per-home and per-person statistics.

An example of the weekly and monthly COLMIS reports is provided in the next section. These reports represent ANY CITY, U.S.A. Figure 3 shows the solid waste organization used in this sample problem.

Figure 3

COLLECTION SYSTEM ORGANIZATION

(ANY CITY, U.S.A.)



COLMIS Edit Reports. All data input, either weekly or monthly, to the COLMIS program are edited for completeness and validity. A detailed description of the input data and the edit criteria is provided later in this chapter. The first page of the edit report identifies, in detail, all data received, whether it was accepted or rejected, and if rejected, the reason for rejection (Figure 4 and 5).

The second page analyzes the quality of input data (Figures 6 and 7). First, the level of participation is reviewed. The percentage of data that should have been submitted, but was not, is provided. A reasonable explanation for absence of data should be sought. Second, the rate of rejection is examined. Excessive rejection rates indicate a lack of understanding of the Daily Collection Route Information form by the crews. This should be easily remedied by additional explanation and guidance from the route supervisors. Third, the percentage of data used is given. This number shows the percent of data that should have been submitted, which was in fact both submitted and valid. The greater the variance of this number from 100 percent, the greater the distortion of the information in the reports, lessening their usefulness as an effective management tool.

Figure 4

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) RESULTS OF EDITING INPUT DATA
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) DISTRICT	(5) ROUTE	(6) DATE	(7) REASON FOR REJECTION

(1) This heading identifies the organization for which the information applies.

(2) Identifies the kind of information included in this section of the report.

(3) The period for which the information of the report applies.

(4) A 2 digit number which identifies the city, district, or major subordinate element of the organization of (1). A separate page is prepared for each city, district, or major subordinate element.

(5) A 2 digit number which identifies the specific route of the city, district, or major subordinate element.

(6) The specific dates in the period of (3) for which data were expected or submitted.

(7) The specific reason for which punch cards are rejected or the notation "no data submitted". Punched cards are rejected because data submitted daily do not meet the criteria established in the edit portion of the program. Criteria are established for route number, vehicle number , fuel and oil consumption, number of homes served, number of loads obtained, net weight collected, total time worked, total distance traveled, the size of the crew, and day of the week. If these items do not conform to the criteria established then the following words are printed, "Route number not programmed", "Vehicle number not programmed", "Fuel", "Oil", "Home", "Load", "Wt", "Time", "Mile", "Crew size", and "Day". If the order of input cards is not in proper sequence, the words "Sequence error" are printed. If data are rejected because a vehicle is replaced, the words "Vehicle replaced", are printed.

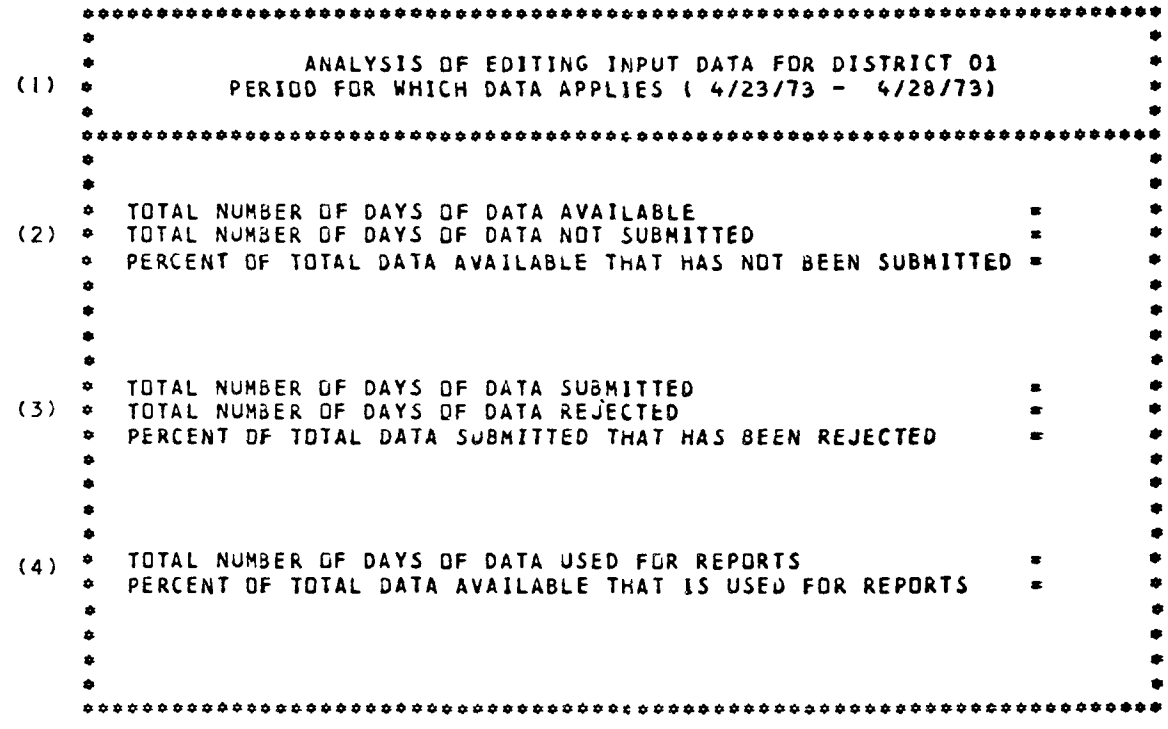
Figure 5

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

RESULTS OF EDITING INPUT DATA
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

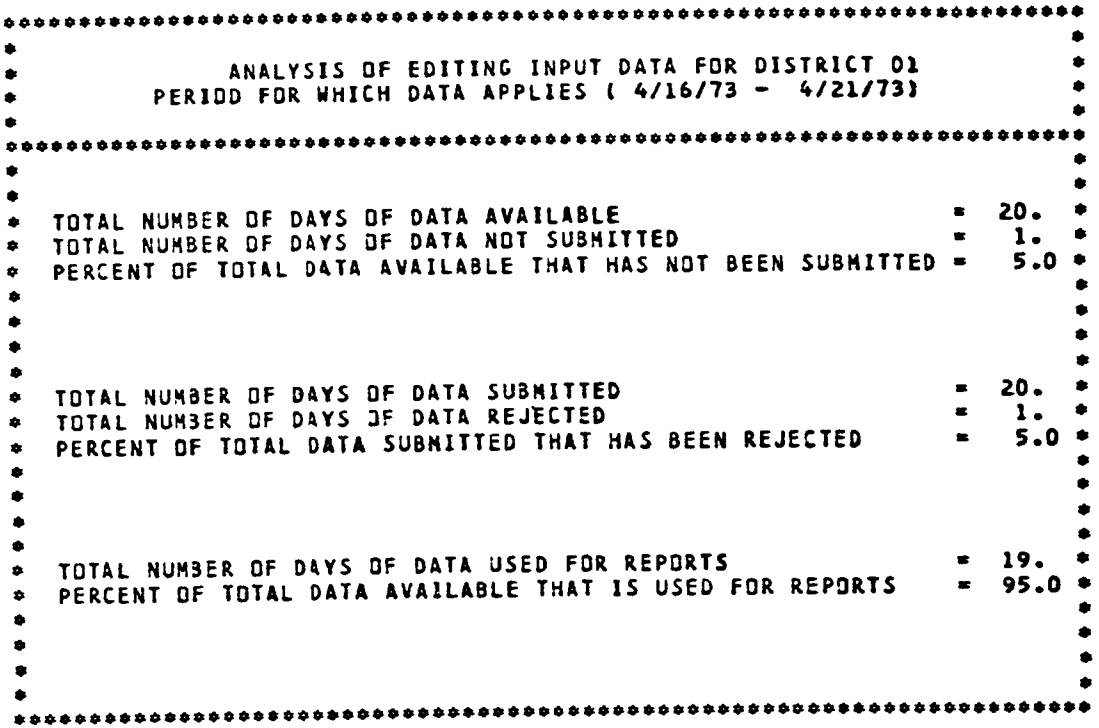
DISTRICT	ROUTE	DATE	REASON FOR REJECTION
01	11	41673.	NO REJECTION
01	11	41773.	NO REJECTION
01	11	41873.	NO REJECTION
01	11	41973.	NO REJECTION
01	11	42073.	NO REJECTION
10	12	41673.	ROUTE NUMBER NOT PROGRAMMED
01	12	41673.	NO DATA SUBMITTED
01	12	41773.	NO REJECTION
01	12	41873.	NO REJECTION
01	12	41973.	NO REJECTION
01	12	42073.	NO REJECTION
01	21	41673.	NO REJECTION
01	21	41773.	NO REJECTION
01	21	41873.	NO REJECTION
01	21	41973.	NO REJECTION
01	21	42073.	NO REJECTION
01	22	41673.	NO REJECTION
01	22	41773.	NO REJECTION
01	22	41873.	NO REJECTION
01	22	41973.	NO REJECTION
01	22	42073.	NO REJECTION

Figure 6



(1) This format provides a recapitulation of the status of data submitted, not submitted, rejected and used in the reports as indicated by (2), (3) and (4). This analysis is provided for each city, district, or major subordinate element of the organization that is designated in the editing report.

Figure 7


ANALYSIS OF EDITING INPUT DATA FOR DISTRICT 01
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)
TOTAL NUMBER OF DAYS OF DATA AVAILABLE = 20.
TOTAL NUMBER OF DAYS OF DATA NOT SUBMITTED = 1.
PERCENT OF TOTAL DATA AVAILABLE THAT HAS NOT BEEN SUBMITTED = 5.0
TOTAL NUMBER OF DAYS OF DATA SUBMITTED = 20.
TOTAL NUMBER OF DAYS OF DATA REJECTED = 1.
PERCENT OF TOTAL DATA SUBMITTED THAT HAS BEEN REJECTED = 5.0
TOTAL NUMBER OF DAYS OF DATA USED FOR REPORTS = 19.
PERCENT OF TOTAL DATA AVAILABLE THAT IS USED FOR REPORTS = 95.0

Weekly COLMIS Reports. Information which will facilitate good management is provided in four reports with three levels of summarization.

The Route Information Report outlines the activities of the collection crews in terms of time, mileage, and weight collected (Figure 8, Table 1, Figures 9, 10, and 11).

The Collection Information Report shows the relationship between the level of crew productivity and the characteristics of the route by considering such factors as persons per home, weight per home, and vehicle capacity (Figure 12, Table 2, Figures 13, 14, and 15).

The Collection Cost Information Report gives a breakdown of cost factors. It shows costs by collection activity, equipment, manpower, and total costs. It also gives good productivity indicators--cost per ton and cost per home (Figure 16, Table 3, Figures 17, 18, and 19).

The Collection System Operation Summary recapitulates on one page the most frequently used figures of the first three reports (Figures 20, 21, 22, and 23).

Each of the above reports is presented in three levels of detail. The first reporting level (Figure 9, for example) gives detailed information for each day of data submitted for each route. The data for each crew are summarized and then the data for all the crews under a route supervisor are summarized. The second reporting level (Figure 10, for example) provides a weekly average for each crew and a summary for all crews under a route supervisor. Figures 9 and 10 show the data for crews under Route Supervisor 01-10; there are similar reports for the other route supervisors - see Volume II, Appendix 1. The third reporting level is the management analysis report (Figure 11, for example). It gives summary information on all route supervisors, all districts, all areas (areas not shown in the example) and for the entire city.

The Comparison Reports rank performance of all the crews on ten productivity indicators. See Figures 24 through 29. The difficulty in weighting these indicators against each other precludes the establishment of a generalized overall productivity ranking of the crews. The importance of each of these factors must be a discretionary judgement made by the managers in each city. Too great a weighting should not be put on any one factor, and none should be ignored.

Let's look, for example, at route 02-12 and 01-11. Starting with Homes Served Per Day (Figure 27), we see that 02-12 is the highest producer, collecting 25 percent more homes than the average. Crew 01-11 is the lowest at 13 percent less than average. Is this a result of how fast the men are collecting? Collection Time Per Home Shows that crew 02-12 can collect a home in 14 percent less time than average and crew 01-11 takes 7 percent longer than average (but is not the slowest). Can the difference be credited only to work speeds of the men? Not entirely. Looking at Average Weight Collected Per Day reveals that while crew 02-12 is collecting 8 percent more than average, crew 01-11 is not far behind at 5 percent above average. This indicates a substantially larger amount of solid waste is generated by each home on route 01-11 than on 02-12. This could be substantiated by reference to the Collection Information Report, given in full in Volume II, Appendix I. Looking next to Average Time Collecting Per Day (Figure 25) reveals that crew 02-12 is spending about 16 percent (.7 hours) more time collecting than crew 01-11. The following variable of Total Time to Route, Collect, Transport (Figure 25) shows that there is a difference of one hour in the total work day. This indicates that not only are the collection duties for the two routes not balanced, but that the "heavier" route also has longer travel distance to the disposal point, making matters worse.

What effect does all this have on costs? See Figure 29. As one might suspect,because neither crew averaged a work day with overtime, the costs per day are very close. Route 02-12 is slightly higher, probably due to occasional occurrence of overtime or higher equipment costs. This can be checked in the detailed Collection Cost Information Reports. Because both routes averaged high on weight collected, Cost Per Ton varies only 1%. The dramatic impact of the imbalance can be seen, however, in Cost Per Home Per Week. The Cost (51¢) for route 01-11 is 42% higher than the cost (36¢) for route 02-12.

This one example shows how all these factors are interrelated. It is impossible, or at least inadvisable, to disregard any of them. If the reason for the variances on the Comparison Reports do not become obvious through the examination of the different indicators, reference should be made back to the appropriate detailed reports.

Figure 8

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) ROUTE INFORMATION REPORT
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) ROUTE NUMBER	(5) DAY OF WEEK	(6) DAYS DATA USED	(7) AVERAGE VEHICLE SIZE AND TYPE	(8) AVERAGE CREW SIZE	(9) MOTOR POOL TO ROUTE (PER DAY)		(10) COLLECTION OPERATION (PER DAY)		(11) TRANSPORT OPERATION (PER DAY)		(12) TIME TO COLLECT XPORT (HOURS)	(13) DOWN TIME ROUTE (HOURS)	(14) LUNCH TIME (HOURS)	(15) WEIGHT PER DAY	
					(MILES)	(HOURS)	(MILES)	(HOURS)	(MILES)	(HOURS)				(POUNDS)	(TONS)

THIS FORMAT IS USED ONLY IN THE WEEKLY PRINTOUT. IN THIS FORMAT DAY OF THE WEEK INFORMATION IS PROVIDED BY ROUTE.

01-11 MON
01-11 TUE
01-11 WED
01-11 THU
01-11 FRI
01-11 SAT
01-11 SUM
(16) 01-11 AVG
01-11 YTD

(1) This heading identifies the organization for which the information applies. If the report is a summary report for the major organization as a whole the additional words "Management Analysis Report" will be included as the last line of the heading.

(2) Identifies the kind of information included in this section of the report. There are four sections to each report. The first section consists of route information; the second section consists of collection information; the third section consists of cost information; and the fourth section is a summary of selected items of information from the previous three sections of the report.

(3) The period for which the information of the report applies.

(4) A 4 digit number that identifies each specific route and indicates its position in the organizational structure. For this management information system a route is defined to be the total efforts of a crew and vehicle for the period of one week.

(5) Indicates the days of the week for which the route data applies.

(6) Number of days of data used in the period of the report. This number may be less than the number of working days in the period for two possible reasons: (a) Data were not provided for each working day; (b) Data were provided for each working day but because of errors in filling out the daily collection route information form the computer program rejected the data.

(7) Average size of vehicle used during the period and takes into consideration substitute vehicles of different sizes.

(8) Average size of crew used during the period.

(9), (10) & (11) Crew activities are viewed in three phases.

The first phase (9) begins with leaving the motor pool and ends with the first collection.
The second phase (10) represents the total collection effort irrespective of the number of loads. For each load the collection phase begins with the first collection and ends with the last collection to complete the load.
The third phase (11) represents the total transport effort and includes returning to the motor pool for the last load of the day. For each load the transport effort begins with the completion of the last collection to make a load and ends with the first collection of a new load or a return to the motor pool for the day. For each phase the average miles traveled per day and the average time in hours per day is presented. The times and mileages exclude that time and mileage associated with down time and lunch time but does include coffee break time.

(12) Represents the average total time spent per day in performing the three phases of the crew activities. Down time and lunch time are excluded from this total time.

(13) Represents the total time in hours that the vehicle was not operating in the period because of a breakdown problem.

Figure 8 (cont'd)

(14) Represents the average time per day in hours that the crew spent for lunch.

(15) Represents the average net weight collected per day and is shown in pounds and tons.

(16) For each of the columns of (6) through (15) a sum, average, and accumulative average (YTD=Year to Date, the accumulative average) is provided where this is meaningful.

TABLE I

ROUTE INFORMATION REPORT FORMULAS

Item to be Computed	Formula
Days of Data Used	Sum of Days of Data
Average Vehicle Size	$\frac{\text{Sum of Vehicle Size}}{\text{Sum of Days of Data Used}}$
Motor Pool to Route	Miles - $\frac{\text{Sum of Miles to Route}}{\text{Sum of Days of Mileage Data Used}}$
	Hours - $\frac{\text{Sum of Minutes to Route}}{\text{Sum of Days of Data Used X 60}}$
Collection Operation	Miles - $\frac{\text{Sum of Collection Miles}}{\text{Sum of Days of Mileage Data Used}}$
	Hours - $\frac{\text{Sum of Collection Minutes}}{\text{Sum of Days of Data Used X 60}}$
Transport Operation	Miles - $\frac{\text{Sum of Transport Miles}}{\text{Sum of Days of Mileage Data Used}}$
	Hours - $\frac{\text{Sum of Transport Minutes}}{\text{Sum of Days of Data Used X 60}}$
Time to Route, Collect, Transport (hours)	Time to Route + Time to Collect + Time to Transport
Down Time (hours)	$\frac{\text{Sum of Breakdown Minutes}}{\text{Sum of Days of Breakdown Data Used X 60}}$
Lunch Time (hours)	$\frac{\text{Sum of Lunch Minutes}}{\text{Sum of Days of Lunch Data Used X 60}}$
Weight Per Day (pounds)	Weight per day is zero if the number of weighed loads is less than 1/2 the total number of loads
	$\frac{\text{Net Weight x Total Number of Loads}}{\text{Number of Weighed Loads x Sum of Days of Data Used}}$
Weight Per Day (tons)	$\frac{\text{Weight Per Day (pounds)}}{2000}$

Figure 9

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER	DAY OF WEEK	DAYS DATA USED	AVERAGE VEHICLE SIZE (CU YD) AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY) (MILES)	MOTOR POOL TO ROUTE (PER DAY) (HOURS)	COLLECTION OPERATION (PER DAY) (MILES)	COLLECTION OPERATION (PER DAY) (HOURS)	TRANSPORT OPERATION (PER DAY) (MILES)	TRANSPORT OPERATION (PER DAY) (HOURS)	TIME TO ROUTE COLLECT XPORT (HOURS)	DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY (POUNDS)	WEIGHT PER DAY (TONS)
01-11	MON	1.0	25-RL	4.0	5.0	0.3	8.0	4.8	22.0	1.4	6.4	----	0.8	25920.	13.0
01-11	TUE	1.0	25-RL	4.0	5.0	0.2	7.0	3.9	22.0	1.3	5.4	----	----	22780.	11.4
01-11	WED	1.0	25-RL	4.0	6.0	0.3	8.0	4.2	21.0	1.3	5.7	----	----	22860.	11.4
01-11	THU	1.0	25-RL	4.0	4.0	0.3	7.0	4.8	24.0	1.5	6.6	----	----	25160.	12.6
01-11	FRI	1.0	25-RL	4.0	3.0	0.2	6.0	4.3	25.0	1.6	6.1	----	0.5	27660.	13.8
01-11	SUM	5.0			23.0	1.1	36.0	22.0	114.0	7.2	30.2	----		124380.	62.2
01-11	AVG	1.0	25-	4.0	4.6	0.2	7.2	4.4	22.8	1.4	6.0		0.6	24876.	12.4
01-11	YTD	1.0	25-	4.0	4.6	0.2	7.2	4.4	22.8	1.4	6.0		0.6	24876.	12.4
01-12	TUE	1.0	25-RL	4.0	3.0	0.3	7.0	5.3	21.0	1.5	7.0	1.5	----	26860.	13.4
01-12	WED	1.0	25-RL	4.0	4.0	0.3	7.0	3.8	23.0	1.3	5.5	----	----	22500.	11.3
01-12	THU	1.0	25-RL	4.0	4.0	0.5	8.0	4.3	23.0	1.3	6.1	----	0.7	23240.	11.6
01-12	FRI	1.0	25-RL	4.0	5.0	0.3	7.0	4.1	23.0	1.2	5.6	----	0.8	21440.	10.7
01-12	SUM	4.0			16.0	1.4	29.0	17.4	90.0	5.3	24.2	1.5		94040.	47.0
01-12	AVG	1.0	25-	4.0	4.0	0.4	7.3	4.4	22.5	1.3	6.0		0.7	23510.	11.8
01-12	YTD	1.0	25-	4.0	4.0	0.4	7.3	4.4	22.5	1.3	6.0		0.7	23510.	11.8
01-10	SUM	9.0			39.0	2.5	65.0	39.4	204.0	12.5	54.4	1.5		218420.	109.2
01-10	AVG	1.0	25-	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1
01-10	YTD	1.0	25-	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1

Figure 10

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		DAYS OF DATA USED	AVERAGE VEHICLE SIZE (CU YD) AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY)		COLLECTION OPERATION (PER DAY)		TRANSPORT OPERATION (PER DAY)		TIME TO ROUTE COLLECT XPORT (HOURS)	TOTAL DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY	
					(MILES)	(HOURS)	(MILES)	(HOURS)	(MILES)	(HOURS)				(POUNDS)	(TONS)
01-11		5.0	25-RL	4.0	4.6	0.2	7.2	4.4	22.8	1.4	6.0	----	0.6	24876.	12.4
01-12		4.0	25-RL	4.0	4.0	0.4	7.3	4.4	22.5	1.3	6.0	1.5	0.7	23510.	11.8
01-10	SUM	9.0			8.6	0.6	14.4	8.8	45.3	2.8	12.1	1.5		48386.	24.2
01-10	AVG	4.5	25-	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1
01-10	YTD	4.5	25-	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1

Figure 11

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		DAYS OF DATA USED	AVERAGE VEHICLE SIZE AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY) (MILES)	(HOURS)	COLLECTION OPERATION (PER DAY) (MILES)	(HOURS)	TRANSPORT OPERATION (PER DAY) (MILES)	(HOURS)	TIME TO ROUTE COLLECT XPORT (HOURS)	TOTAL DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY (POUNDS)	(TONS)
01-10	SUM	9.0			8.6	0.6	14.4	8.8	45.3	2.8	12.1	1.5		48386.	24.2
01-10	AVG	4.5	25-RL	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1
01-10	YTD	4.5	25-RL	4.0	4.3	0.3	7.2	4.4	22.7	1.4	6.0		0.7	24269.	12.1
01-20	SUM	10.0			7.8	0.5	15.4	9.8	47.8	2.6	13.0	1.0		48617.	24.3
01-20	AVG	5.0	24-RL	4.0	3.9	0.3	7.7	4.9	23.9	1.3	6.5		0.5	24398.	12.2
01-20	YTD	5.0	24-RL	4.0	3.9	0.3	7.7	4.9	23.9	1.3	6.5		0.5	24398.	12.2
02-10	SUM	8.0			7.8	0.4	17.3	9.6	52.8	3.3	13.3	1.9		48845.	24.4
02-10	AVG	4.0	20-RL	4.0	3.9	0.2	8.6	4.8	26.4	1.6	6.7		0.5	24422.	12.2
02-10	YTD	4.0	20-RL	4.0	3.9	0.2	8.6	4.8	26.4	1.6	6.7		0.5	24422.	12.2
02-20	SUM	10.0			13.0	0.5	18.2	9.9	52.4	2.7	13.1	1.9		43681.	21.8
02-20	AVG	5.0	20-RL	4.0	6.5	0.2	9.1	4.9	26.2	1.3	6.5		0.5	21825.	10.9
02-20	YTD	5.0	20-RL	4.0	6.5	0.2	9.1	4.9	26.2	1.3	6.5		0.5	21825.	10.9
01-00	SUM	19.0			16.4	1.1	29.8	18.6	93.1	5.4	25.1	2.5		97003.	48.5
01-00	AVG	4.8	24-RL	4.0	4.1	0.3	7.5	4.7	23.3	1.3	6.3		0.6	24338.	12.2
01-00	YTD	4.8	24-RL	4.0	4.1	0.3	7.5	4.7	23.3	1.3	6.3		0.6	24338.	12.2
02-00	SUM	18.0			20.7	0.9	35.4	19.5	105.1	6.0	26.4	3.8		92526.	46.3
02-00	AVG	4.5	20-RL	4.0	5.3	0.2	8.9	4.9	26.3	1.5	6.6		0.5	22982.	11.5
02-00	YTD	4.5	20-RL	4.0	5.3	0.2	8.9	4.9	26.3	1.5	6.6		0.5	22982.	11.5
99-99	SUM	37.0			37.1	2.0	65.3	38.1	198.2	11.4	51.5	6.3		189528.	94.8
99-99	AVG	4.6	22-RL	4.0	4.7	0.3	8.2	4.8	24.8	1.4	6.4		0.6	23680.	11.8
99-99	YTD	4.6	22-RL	4.0	4.7	0.3	8.2	4.8	24.8	1.4	6.4		0.6	23680.	11.8

5.% OF DATA USED INCLUDED ESTIMATED MILEAGE.
95.% OF DATA USED.

Figure 12

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION INFORMATION REPORT
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) ROUTE NUMBER	(5) DAY OF WEEK	(6) HOMES SERVED PER COLLECT DAY (POUNDS)	(7) WEIGHT PER HOME COLLECT DAY (POUNDS)	(8) PERSONS SERVED PER DAY	(9) GENERATE PER PERSON PER DAY (POUNDS)	(10) COLLECT TIME PER HOME (MIN)	(11) COLLECT TIME PER 100LBS (MIN)	(12) COLLECT TIME TO TOTAL TIME WORKED	(13) TOTAL TIME WORKED TO STANDARD TIME	(14) LOADS PER DAY INCIN	LAND FILL	XFER STA	(15) WEIGHT PER CU YD 1ST LOAD (POUNDS)
	01-11	MON											
	01-11	TUE											
	01-11	WED											
	01-11	THU											
	01-11	FRI											
	01-11	SAT											
	01-11	SUM											
(16)	01-11	AVG											
	01-11	YTD											

THIS FORMAT IS USED ONLY IN WEEKLY PRINTOUT. IN THIS FORMAT DAY OF THE WEEK INFORMATION IS PROVIDED BY ROUTE.

(1), (2), (3), (4) & (5) *Same as the corresponding items from the Route Information Report.*

(6) Indicates the average number of family units served per day.

(7) Indicates the average weight collected from each family unit on a collection day basis.

(8) Indicates the average number of persons served per collection day. This number is based on the number of family units served per day and the statistical average number of people per family unit in the area of the route.

(9) Indicates the average daily (seven days a week) quantity of solid waste generated per person and is based on the weight collected per home per day and the average number of people per family unit in the area of the route.

(10) Indicates the average time in minutes, required to service one family unit.

(11) Indicates the average time in minutes, required to collect 100 pounds of solid waste from the route.

(12) Indicates the proportion of time spent in collecting solid waste in comparison with the total time spent working including going to the route, collecting and transporting waste, time spent in breakdowns and excess lunch time.

(13) Indicates the proportion of time spent in traveling to the route, collecting and transporting waste, time spent in breakdowns and excess lunch time in comparison with the time of the standard work day.

(14) Indicates the number of loads per day transported to the disposal sites listed. Any combination of three disposal sites can be listed.

(15) Indicates the degree of compaction being obtained on the first load with the equipment being used and the solid waste being collected. It is assumed that the first load in all cases is a full load.

(16) For each of the columns of (6) through (15) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

TABLE 2

COLLECTION INFORMATION REPORT FORMULAS

Item to be Computed	Formula
Total Time Worked	Time to Route, Collect, Transport + Down Time + Excess Lunch Time
Homes Served Per Collect Day	$\frac{\text{Sum of Homes Served Per Day}}{\text{Sum of Days of Data Used}}$
Weight Per Home Per Collect Day (pounds)	$\frac{\text{Weight Per Day (pounds)}}{\text{Homes Served Per Collect Day}}$
Persons Served Per Collect Day	Homes Served Per Collect Day X Number of People Per Home
Generate Per Person Per Day (pounds)	$\frac{\text{Weight Per Day (pounds) X Collection Frequency}}{\text{Persons Served Per Collect Day X 7}}$
Collect Time Per Home (minutes)	$\frac{\text{Collect Minutes Per Day}}{\text{Homes Served Per Collect Day}}$
Collect Time Per 100 Pounds (minutes)	$\frac{\text{Collect Minutes Per Day X 100}}{\text{Weight Per Day (pounds)}}$
Collect Time to Total Time Worked	$\frac{\text{Collect Minutes Per Day}}{\text{Total Time Worked}}$
Total Time Worked to Standard Time	$\frac{\text{Total Time Worked}}{\text{Length of Work Day}}$
Loads Per Day	
Incinerator	$\frac{\text{Sum of Loads to Incinerator}}{\text{Sum of Days of Data Used}}$
Landfill	$\frac{\text{Sum of Loads to Landfill}}{\text{Sum of Days of Data Used}}$
Transfer Station	$\frac{\text{Sum of Loads to Transfer Station}}{\text{Sum of Days of Data Used}}$
Weight Per Cubic Yard First Load (pounds)	$\frac{\text{Sum of Weight of First Loads X Average Vehicle Size}}{\text{Sum of Number of Weighed First Loads}}$

Figure 13

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER	DAY OF WEEK	HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY INCIN	LOADS PER DAY LAND FILL	LOADS PER DAY XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-11	MON	425.	61.0	1300.	2.8	0.67	1.10	0.71	0.83	0.	2.	0.	705.
01-11	TUE	358.	63.6	1095.	3.0	0.66	1.03	0.72	0.68	0.	2.	0.	626.
01-11	WED	399.	57.3	1221.	2.7	0.63	1.09	0.72	0.72	0.	2.	0.	483.
01-11	THU	480.	52.4	1469.	2.4	0.60	1.15	0.73	0.82	0.	2.	0.	600.
01-11	FRI	391.	70.7	1196.	3.3	0.66	0.94	0.71	0.76	0.	2.	0.	600.
01-11	SUM	2053.		6282.						0.	10.	0.	
01-11	AVG	411.	60.6	1256.	2.8	0.64	1.06	0.71	0.77	0.	2.	0.	603.
01-11	YTD	411.	60.6	1256.	2.8	0.64	1.06	0.71	0.77	0.	2.	0.	603.
01-12	TUE	400.	67.1	1224.	3.1	0.79	1.17	0.62	1.06	0.	2.	0.	594.
01-12	WED	466.	48.3	1426.	2.3	0.49	1.02	0.70	0.69	0.	2.	0.	554.
01-12	THU	506.	45.9	1548.	2.1	0.50	1.10	0.68	0.78	0.	2.	0.	557.
01-12	FRI	434.	49.4	1328.	2.3	0.56	1.14	0.70	0.73	0.	2.	0.	622.
01-12	SUM	1806.		5526.						0.	8.	0.	
01-12	AVG	452.	52.1	1382.	2.4	0.58	1.11	0.66	0.83	0.	2.	0.	582.
01-12	YTD	452.	52.1	1382.	2.4	0.58	1.11	0.66	0.83	0.	2.	0.	582.
01-10	SUM	3859.		11809.						0.	18.	0.	
01-10	AVG	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.
01-10	YTD	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.

Figure 14

ANN ARBOR, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY INCIN	LOADS PER DAY LAND FILL	LOADS PER DAY XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-11		411.	60.6	1256.	2.8	0.64	1.06	0.71	0.77	0.	2.	0.	603.
01-12		452.	52.1	1382.	2.4	0.58	1.11	0.66	0.83	0.	2.	0.	582.
01-10	SUM	862.		2638.						0.	4.	0.	
01-10	AVG	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.
01-10	YTD	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.

Figure 15

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY: INCIN	LOADS PER DAY: LAND FILL	LOADS PER DAY: XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-10	SUM	862.		2638.						0.	4.	0.	
01-10	AVG	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.
01-10	YTD	429.	56.6	1312.	2.6	0.61	1.08	0.69	0.80	0.	2.	0.	593.
01-20	SUM	871.		2508.						0.	4.	0.	
01-20	AVG	435.	56.0	1254.	2.8	0.68	1.21	0.75	0.82	0.	2.	0.	601.
01-20	YTD	435.	56.0	1254.	2.8	0.68	1.21	0.75	0.82	0.	2.	0.	601.
02-10	SUM	1081.		3309.						0.	5.	0.	
02-10	AVG	541.	45.2	1654.	2.1	0.53	1.18	0.69	0.87	0.	2.	0.	567.
02-10	YTD	541.	45.2	1654.	2.1	0.53	1.18	0.69	0.87	0.	2.	0.	567.
02-20	SUM	999.		2877.						0.	4.	0.	
02-20	AVG	499.	43.7	1438.	2.2	0.59	1.36	0.73	0.85	0.	2.	0.	571.
02-20	YTD	499.	43.7	1438.	2.2	0.59	1.36	0.73	0.85	0.	2.	0.	571.
01-00	SUM	1733.		5146.						0.	8.	0.	
01-00	AVG	432.	56.3	1284.	2.7	0.65	1.15	0.72	0.81	0.	2.	0.	597.
01-00	YTD	432.	56.3	1284.	2.7	0.65	1.15	0.72	0.81	0.	2.	0.	597.
02-00	SUM	2080.		6185.						0.	9.	0.	
02-00	AVG	518.	44.4	1538.	2.1	0.57	1.27	0.71	0.86	0.	2.	0.	569.
02-00	YTD	518.	44.4	1538.	2.1	0.57	1.27	0.71	0.86	0.	2.	0.	569.
99-99	SUM	3813.		11331.						0.	17.	0.	
99-99	AVG	474.	50.0	1407.	2.4	0.60	1.21	0.72	0.83	0.	2.	0.	585.
99-99	YTD	474.	50.0	1407.	2.4	0.60	1.21	0.72	0.83	0.	2.	0.	585.

Figure 16

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION COST INFORMATION IN DOLLARS
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) ROUTE NUMBER	(5) DAY OF WEEK	(6) COST TO ROUTE	(7) COST TO COLLECT	(8) COST TO XPORT	(9) EQUIP-MENT COST	(10) MANPOWER COST	(11) TOTAL COST	(12) BREAK-DOWN COST (MANPWR)	(13) INCEN-TIVE COST	(14) OVER-TIME COST	(15) COST PER TON	(16) COST PER HOME PER WEEK	(16) COST PER HOME PER YEAR

THIS FORMAT IS USED ONLY IN THE WEEKLY PRINTOUT. IN THIS FORMAT DAY OF THE WEEK INFORMATION IS PROVIDED BY ROUTE.

01-11 MON
01-11 TUE
01-11 WED
01-11 THU
01-11 FRI
01-11 SAT
(17) 01-11 SUM
01-11 AVG
01-11 YTD

(1), (2), (3), (4) & (5) Same as the corresponding items from the Route Information Report.

(6) Indicates the sum of the equipment and personnel costs per day to travel from the motor pool to the first collection. These costs are based on the time required to perform this operation.

(7) Indicates the sum of the equipment and personnel costs per day to complete the total collection phase of the effort. These costs are based on the time required to complete the collection effort.

(8) Indicates the sum of the equipment and personnel costs per day to complete the transport phase of the effort. These costs are based on the time required to complete the transport effort.

(9) Indicates the total cost of operating the equipment per day and includes depreciation, maintenance, and daily consumable costs.

(10) Indicates the total personnel costs per day. The personnel costs will include the time to route, collect, transport and overtime costs. All time worked in excess of the normally paid workday, including time associated with a breakdown and excess lunch time, will be used to compute overtime costs. The personnel costs can include the costs of labor, fringe benefits and personnel overhead.

(11) Indicates the total daily equipment and personnel costs per day. This total cost is also the sum of the costs to go to the route, to collect and to transport.

(12) Indicates the total personnel operating costs of the breakdowns in the period based on the daily manpower costs and the time required to solve the breakdown problems. This costs does NOT include the actual parts and maintenance labor costs associated with correcting the breakdown problem.

(13) Indicates the daily cost of the crew which is paid when the crew is not working a full standard day.

(14) Indicates the daily cost of the crew which is paid when the crew works longer than the standard day.

(15) Indicates the total equipment and personnel costs required to collect and transport one ton of solid waste to the disposal point.

(16) Indicates the total equipment and personnel costs required to service one family unit per week and per year.

(17) For each of the columns of (6) through (16) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

TABLE 3

COST INFORMATION REPORT FORMULAS

Item to be Computed	Formula
Equipment Cost Per Day	$\frac{\text{Sum of Equipment Cost (dollars)}}{\text{Sum of Days of Data Used}}$
Equipment Cost Per Operating Minute	$\frac{\text{Equipment Cost Per Day (dollars)}}{\text{Time to Route + Time to Collect + Time to Transport (minutes)}}$
If total time worked is greater than the length of the work day then overtime cost is computed and incentive cost is zero.	
Overtime Pay	Driver's Salary (dollars) X Overtime Factor (driver) + (average crew size -1) X Collector's Salary (dollars) X Overtime Factor (collector)
Overtime Cost	$\frac{\text{Total Time Worked (minutes) - Length of Workday (minutes) X Overtime Pay (dollars)}}{60}$
Incentive Cost	$\frac{\text{Length of Workday (minutes) - Total Time Worked (minutes) X Driver's Salary (dollars) + (average crew size -1) X Collector's Salary (dollars)}}{60}$
Manpower Cost Per Day	Length of Workday (hours) X Driver's Salary (dollars) + (average crew size - 1) X Collector's Salary (dollars) + Overtime Cost
If day is not a normal work day and total time worked is less than or equal to one-half the work then:	
Overtime Cost	$\frac{\text{Length of Workday (hours) X Overtime Pay}}{2}$
	Manpower Cost = Overtime Cost
If the total time worked is greater than one-half work day and less than or equal to the workday then:	
Overtime Cost	Length of Workday (hours) X Overtime Pay
	Manpower Cost = Overtime Cost

TABLE 3 (con't)

COST INFORMATION REPORT FORMULAS

Item to be Computed	Formula
If total time worked is greater than the workday then:	
Overtime Cost	Total Time Worked X Overtime Pay Manpower Cost = Overtime Cost
The Average Manpower Cost	$\frac{\text{Sum of Manpower Cost}}{\text{Sum of Days of Cost Data Used}}$
Average overtime and incentive costs are not computed.	
Manpower Cost Per Operating Minute	$\frac{\text{Manpower Cost}}{\text{Time to Route + Time to Collect + Time to Transport}}$
Cost to Route	(equipment cost per operating minute + manpower cost per operating minute) X Time to Route (minutes)
Cost to Collect	(equipment cost per operating minute + manpower cost per operating minute) X Time to Collect (minutes)
Cost to Transport	(equipment cost per operating minute + manpower cost per operating minute) X Time to Transport (minutes)
Total Cost	Manpower Cost + Equipment Cost
Breakdown Cost	Manpower Cost per Operating Minute X Down Time (minutes)
Cost Per Ton	$\frac{\text{Total Cost}}{\text{Weight Per Day (tons)}}$
Cost Per Home Per Week	$\frac{\text{Total Cost X Collection Frequency}}{\text{Homes Served Per Collection Day}}$
Cost Per Home Per Year	Cost Per Home Per Week (hundredths of dollars) x 52

Figure 17

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION COST INFORMATION IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER	DAY OF WEEK	COST TO ROUTE	COST TO COLLECT	COST TO XPORT	EQUIP-MENT COST	MANPOWER COST	TOTAL COST	BREAK-DOWN COST (MANPWR)	INCEN-TIVE COST	OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-11	MON	8.07	153.36	45.74	30.77	176.40	207.17	0.0	29.40	0.0	15.99	0.49	25.48
01-11	TUE	6.35	149.21	50.80	29.96	176.40	206.36	0.0	56.96	0.0	18.12	0.58	30.16
01-11	WED	9.03	150.51	48.16	31.31	176.40	207.71	0.0	49.61	0.0	18.17	0.52	27.04
01-11	THU	7.89	152.50	47.33	31.31	176.40	207.71	0.0	31.24	0.0	16.51	0.43	22.36
01-11	FRI	5.73	148.92	54.41	32.66	176.40	209.06	0.0	42.26	0.0	15.12	0.53	27.56
01-11	SUM	37.07	754.50	246.44	156.01	882.00	1038.01	0.0	209.47	0.0			
01-11	AVG	7.43	150.98	49.18	31.20	176.40	207.60				16.69	0.51	26.52
01-11	YTD	7.43	150.98	49.18	31.20	176.40	207.60				16.69	0.51	26.52
01-12	TUE	7.54	158.38	45.25	30.50	180.67	211.17	38.72	0.0	4.27	15.72	0.53	27.56
01-12	WED	12.65	145.52	50.62	32.39	176.40	208.79	0.0	55.12	0.0	18.56	0.45	23.40
01-12	THU	17.03	144.74	45.41	30.77	176.40	207.17	0.0	38.59	0.0	17.83	0.41	21.32
01-12	FRI	12.37	151.51	43.29	30.77	176.40	207.17	0.0	47.77	0.0	19.33	0.48	24.96
01-12	SUM	49.59	600.15	184.56	124.43	709.87	834.30	38.72	141.49	4.27			
01-12	AVG	12.23	150.32	46.03	31.11	177.47	208.58				17.74	0.46	23.92
01-12	YTD	12.23	150.32	46.03	31.11	177.47	208.58				17.74	0.46	23.92
01-10	SUM	86.66	1354.65	431.00	280.44	1591.87	1872.31	38.72	350.96	4.27			
01-10	AVG	8.66	150.69	47.79	31.16	176.87	208.03				17.16	0.49	25.48
01-10	YTD	8.66	150.69	47.79	31.16	176.87	208.03				17.16	0.49	25.48

Figure 18

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION COST INFORMATION IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		COST TO ROUTE PER DAY	COST TO COLLECT PER DAY	COST TO XPORT PER DAY	EQUIP-MENT COST PER DAY	MANPOWER COST PER DAY	TOTAL COST PER DAY	TOTAL BREAK-DOWN COST (MANPWR)	TOTAL INCEN-TIVE COST	TOTAL OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-11		7.43	150.98	49.18	31.20	176.40	207.60	0.0	209.47	0.0	16.69	0.51	26.52
01-12		12.23	150.32	46.03	31.11	177.47	208.58	38.72	141.49	4.27	17.74	0.46	23.92
01-10	SUM	19.66	301.30	95.21	62.31	353.87	416.18	38.72	350.96	4.27			
01-10	AVG	9.56	150.69	47.79	31.16	176.87	208.03				17.14	0.49	25.48
01-10	YTD	9.56	150.69	47.79	31.16	176.87	208.03				17.14	0.49	25.48

Figure 19

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION COST INFORMATION IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		COST TO ROUTE PER DAY	COST TO COLLECT PER DAY	COST TO XPORT PER DAY	EQUIP-MENT COST PER DAY	MANPOWER COST PER DAY	TOTAL COST PER DAY	TOTAL BREAK-DOWN COST (MANPWR)	TOTAL INCEN-TIVE COST	TOTAL OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-10	SUM	19.66	301.30	95.21	62.31	353.87	416.18	38.72	350.96	4.27			
01-10	AVG	9.56	150.69	47.79	31.16	176.87	208.03				17.14	0.49	25.48
01-10	YTD	9.56	150.69	47.79	31.16	176.87	208.03				17.14	0.49	25.48
01-20	SUM	17.34	316.45	83.51	63.21	354.08	417.29	23.59	323.40	6.41			
01-20	AVG	8.58	158.23	41.84	31.60	177.04	208.64				17.10	0.48	24.96
01-20	YTD	8.58	158.23	41.84	31.60	177.04	208.64				17.10	0.48	24.96
02-10	SUM	13.86	303.07	104.83	66.47	355.29	421.77	52.12	209.47	9.97			
02-10	AVG	6.93	151.68	52.28	33.24	177.65	210.88				17.27	0.39	20.28
02-10	YTD	6.93	151.68	52.28	33.24	177.65	210.88				17.27	0.39	20.28
02-20	SUM	15.46	315.89	85.96	64.50	352.80	417.30	55.94	266.44	0.0			
02-20	AVG	7.71	157.88	43.06	32.25	176.40	208.65				19.12	0.42	21.84
02-20	YTD	7.71	157.88	43.06	32.25	176.40	208.65				19.12	0.42	21.84
01-00	SUM	37.00	617.75	178.72	125.52	707.95	833.47	62.30	674.36	10.69			
01-00	AVG	9.03	154.77	44.55	31.39	176.96	208.36				17.12	0.48	24.96
01-00	YTD	9.03	154.77	44.55	31.39	176.96	208.36				17.12	0.48	24.96
02-00	SUM	29.32	618.96	190.79	130.98	708.09	839.07	108.06	475.91	9.97			
02-00	AVG	7.36	155.11	47.17	32.69	176.95	209.64				18.24	0.40	20.80
02-00	YTD	7.36	155.11	47.17	32.69	176.95	209.64				18.24	0.40	20.80
99-99	SUM	66.32	1236.71	369.51	256.49	1416.04	1672.54	170.37	1150.27	20.66			
99-99	AVG	8.20	154.93	45.85	32.02	176.96	208.98				17.65	0.44	22.88
99-99	YTD	8.20	154.93	45.85	32.02	176.96	208.98				17.65	0.44	22.88

Figure 20

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION SYSTEM OPERATION SUMMARY
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) ROUTE NUMBER	(5) DAY OF WEEK	(6) HOMES SERVED PER COLLECT DAY	(7) WEIGHT PER HOME* PER COLLECT DAY (POUNDS)	(8) WEIGHT PER DAY (TONS)	(9) COLLECT TIME PER HOME (MIN)	(10) TIME TO ROUTE XPORT (HOURS)	(11) COLLECT TIME TO WORKED	(12) TOTAL TIME *WORKED TO STANDARD	(13) COST PER TON ACTUAL	(13) PERCENT DIFF FROM AVERAGE	(14) COST PER HOME PER WEEK ACTUAL	(14) PERCENT DIFF FROM AVERAGE

THIS FORMAT IS USED ONLY IN THE WEEKLY PRINTOUT. IN THIS FORMAT DAY OF THE WEEK INFORMATION IS PROVIDED BY ROUTE.

01-11	MON	(1), (2), (3), (4) & (5) Same as the corresponding items from the Route Information Report.
01-11	TUE	
01-11	WED	(6) From the Collection Information Report.
01-11	THU	
01-11	FRI	(7) From the Collection Information Report.
01-11	SAT	
		(8) From the Route Information Report.
01-11	SUM	
(15,01-11	AVG	(9) From the Collection Information Report.
01-11	YTD	
		(10) From the Route Information Report.
		(11) From the Collection Information Report.
		(12) From the Collection Information Report.
		(13) From the Cost Information Report. The percent difference from the city accumulative (YTD) average is also provided.
		(14) From the Cost Information Report. The percent difference from the city accumulative (YTD) average is also provided.
		(15) For each of the columns of (6) through (14) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

Figure 21

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION SYSTEM OPERATION SUMMARY
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER	DAY OF WEEK	HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-11	MON	425.	61.0	13.0	0.67	6.4	0.71	0.83	15.99	-9.	0.49	11.
01-11	TUE	358.	63.6	11.4	0.66	5.4	0.72	0.68	18.12	3.	0.58	32.
01-11	WED	399.	57.3	11.4	0.63	5.7	0.72	0.72	18.17	3.	0.52	18.
01-11	THU	480.	52.4	12.6	0.60	6.6	0.73	0.92	16.51	-6.	0.43	-2.
01-11	FRI	391.	70.7	13.8	0.66	6.1	0.71	0.76	15.12	-14.	0.53	20.
01-11	SUM	2053.		62.2		30.2						
01-11	AVG	411.	60.6	12.4	0.64	6.0	0.71	0.77	16.69	-5.	0.51	16.
01-11	YTD	411.	60.6	12.4	0.64	6.0	0.71	0.77	16.69	-5.	0.51	16.
01-12	TUE	400.	67.1	13.4	0.79	7.0	0.62	1.06	15.72	-11.	0.53	20.
01-12	WED	466.	48.3	11.3	0.49	5.5	0.70	0.69	18.56	5.	0.45	2.
01-12	THU	506.	45.9	11.6	0.50	6.1	0.68	0.78	17.83	1.	0.41	-7.
01-12	FRI	434.	49.4	10.7	0.56	5.6	0.70	0.73	19.33	9.	0.48	9.
01-12	SUM	1806.		47.0		24.2						
01-12	AVG	452.	52.1	11.8	0.58	6.0	0.66	0.83	17.74	1.	0.46	5.
01-12	YTD	452.	52.1	11.8	0.58	6.0	0.66	0.83	17.74	1.	0.46	5.
01-10	SUM	3859.		109.2		54.4						
01-10	AVG	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.
01-10	YTD	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.

Figure 22

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION SYSTEM OPERATION SUMMARY
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-11		411.	60.6	12.4	0.64	6.0	0.71	0.77	16.69	-5.	0.51	16.
01-12		452.	52.1	11.8	0.58	6.0	0.66	0.83	17.74	1.	0.46	5.
01-10	SUM	862.		24.2		12.1						
01-10	AVG	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.
01-10	YTD	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.

Figure 23

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION SYSTEM OPERATION SUMMARY
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-10	SUM	862.		24.2		12.1						
01-10	AVG	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.
01-10	YTD	429.	56.6	12.1	0.61	6.0	0.69	0.80	17.14	-3.	0.49	11.
01-20	SUM	871.		24.3		13.0						
01-20	AVG	435.	56.0	12.2	0.68	6.5	0.75	0.82	17.10	-3.	0.48	9.
01-20	YTD	435.	56.0	12.2	0.68	6.5	0.75	0.82	17.10	-3.	0.48	9.
02-10	SUM	1081.		24.4		13.3						
02-10	AVG	541.	45.2	12.2	0.53	6.7	0.69	0.87	17.27	-2.	0.39	-11.
02-10	YTD	541.	45.2	12.2	0.53	6.7	0.69	0.87	17.27	-2.	0.39	-11.
02-20	SUM	999.		21.8		13.1						
02-20	AVG	499.	43.7	10.9	0.59	6.5	0.73	0.85	19.12	8.	0.42	-5.
02-20	YTD	499.	43.7	10.9	0.59	6.5	0.73	0.85	19.12	8.	0.42	-5.
01-00	SUM	1733.		48.5		25.1						
01-00	AVG	432.	56.3	12.2	0.65	6.3	0.72	0.81	17.12	-3.	0.48	9.
01-00	YTD	432.	56.3	12.2	0.65	6.3	0.72	0.81	17.12	-3.	0.48	9.
02-00	SUM	2080.		46.3		26.4						
02-00	AVG	518.	44.4	11.5	0.57	6.6	0.71	0.86	18.24	3.	0.40	-9.
02-00	YTD	518.	44.4	11.5	0.57	6.6	0.71	0.86	18.24	3.	0.40	-9.
99-99	SUM	3813.		94.8		51.5						
99-99	AVG	474.	50.0	11.8	0.60	6.4	0.72	0.83	17.65	0.	0.44	0.
99-99	YTD	474.	50.0	11.8	0.60	6.4	0.72	0.83	17.65	0.	0.44	0.

Figure 24

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

(2) COMPARISON REPORT: ANALYSIS OF ROUTE INFORMATION REPORT
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	(5) ORDERED BY COMPARISON WITH CITY YTD	(6) INDIVIDUAL YTD VALUE	(7) PERCENT DIFF FROM CITY YTD	(8) VALUE THIS PERIOD	(9) PERCENT DIFF FROM INDIVIDUAL YTD
(10) AVERAGE TIME COLLECTING PER DAY (HOURS) (11) ( )					
(10) TOTAL TIME TO ROUTE, COLLECT TRANSPORT (HOURS) (11) ( )					
(10) AVERAGE WEIGHT COLLECTED PER DAY (TONS) (11) ( )					

(1) This heading identifies the organization for which the information applies.

(2) Identifies the kind of information included in this section of the report. Comparison reports are provided only for the "Management Analysis Report".

(3) The period for which the information of the report applies.

(4) Indicates the variable from the Route Information Report that will be considered for analysis.

(5) Indicates the relative order of the organizational elements when ranked against the accumulative average (YTD = Year to Date) of the city as a whole. The organizational elements are ordered with the best performing element listed first.

(6) Indicates the actual value of the accumulative average (YTD) for the organizational elements and the variable considered.

(7) Indicates the percent difference (+ or -) the YTD of the organizational element differs from the YTD Of the city as a whole.

(8) Indicates the value of the variable being considered for the period indicated and the organizational element listed under (5).

(9) Indicates the percent difference (+ or -) the value under (8) differs from the YTD value (6) of the organizational element listed under (5).

(10) Indicates the specific variable from the Route Information Report that is considered for analysis.

(11) Indicates the YTD of the city against which the organizational elements in (5) will be ranked.

Figure 25

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
AVERAGE TIME COLLECTING PER DAY (HOURS) (4.8)	02-12	5.1	8.	5.1	0.
	01-21	5.1	8.	5.1	0.
	02-22	5.1	7.	5.1	0.
	02-21	4.8	1.	4.8	0.
	01-22	4.7	-1.	4.7	0.
	02-11	4.4	-7.	4.4	0.
	01-11	4.4	-8.	4.4	0.
	01-12	4.4	-9.	4.4	0.
TOTAL TIME TO ROUTE, COLLECT, TRANSPORT (HOURS) (6.4)	02-12	7.0	9.	7.0	0.
	02-22	6.8	5.	6.8	0.
	01-21	6.8	5.	6.8	0.
	02-11	6.3	-2.	6.3	0.
	02-21	6.3	-2.	6.3	0.
	01-22	6.2	-4.	6.2	0.
	01-11	6.0	-6.	6.0	0.
	01-12	6.0	-6.	6.0	0.
AVERAGE WEIGHT COLLECTED PER DAY (TONS) (11.8)	02-12	12.8	8.	12.8	0.
	01-21	12.5	6.	12.5	0.
	01-11	12.4	5.	12.4	0.
	01-22	11.8	-0.	11.8	0.
	01-12	11.8	-1.	11.8	0.
	02-11	11.6	-2.	11.6	0.
	02-22	11.3	-5.	11.3	0.
	02-21	10.6	-11.	10.6	0.

Figure 26

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

(2) COMPARISON REPORT: ANALYSIS OF COLLECTION INFORMATION REPORT
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	(5) ORDERED BY COMPARISON WITH CITY YTD	(6) INDIVIDUAL YTD VALUE	(7) PERCENT DIFF FROM CITY YTD	(8) VALUE THIS PERIOD	(9) PERCENT DIFF FROM INDIVIDUAL YTD

(10) HOMES SERVED PER DAY
(11) ( )

(1) This heading identifies the organization for which the information applies.

(2) Identifies the kind of information included in this section of the report. Comparison reports are provided only for the "Management Analysis Report".

(3) The period for which the information of the report applies.

---

(10) COLLECTION TIME PER HOME (MINUTES)
(11) ( )

(4) Indicates the variable from the Collection Information Report that will be considered for analysis.

(5) Indicates the relative order of the organizational elements when ranked against the accumulative average (YTD = Year to Date) of the city as a whole. The organizational elements are ordered with the best performing element listed first.

---

(10) COLLECTION TIME TO TOTAL TIME WORKED
(11) ( )

(6) Indicates the actual value of the accumulative average (YTD) for the organizational elements and the variable considered.

(7) Indicates the percent difference (+ or -) the YTD of the organizational element differs from the YTD of the city as a whole.

---

(10) TOTAL TIME WORKED TO STANDARD TIME
(11) ( )

(8) Indicates the value of the variable being considered for the period indicated and the organizational element listed under (5).

(9) Indicates the percent difference (+ or-) the value under (8) differs from the YTD value (6) of the organizational element listed under (5).

(10) Indicates the specific variable from the Collection Information Report that is considered for analysis.

(11) Indicates the YTD of the city against which the organizational elements in (5) will be ranked.

Figure 27

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
HOMES SERVED PER DAY	02-12	592.	25.	592.	0.
	02-22	500.	5.	500.	0.
	02-21	499.	5.	499.	0.
	02-11	489.	3.	489.	0.
(474.)	01-12	452.	-5.	452.	0.
	01-21	443.	-7.	443.	0.
	01-22	428.	-10.	428.	0.
	01-11	411.	-13.	411.	0.
COLLECTION TIME PER HOME (MINUTES)	02-12	0.52	-14.	0.52	0.
	02-11	0.54	-10.	0.54	0.
	01-12	0.58	-4.	0.58	0.
	02-21	0.58	-4.	0.58	0.
(0.60)	02-22	0.61	1.	0.61	0.
	01-11	0.64	7.	0.64	0.
	01-22	0.66	9.	0.66	0.
	01-21	0.70	15.	0.70	0.
COLLECTION TIME TO TOTAL TIME WORKED	01-22	0.76	6.	0.76	0.
	02-22	0.74	4.	0.74	0.
	01-21	0.73	2.	0.73	0.
	02-21	0.72	0.	0.72	0.
(0.72)	01-11	0.71	-1.	0.71	0.
	02-12	0.70	-2.	0.70	0.
	02-11	0.68	-5.	0.68	0.
	01-12	0.66	-8.	0.66	0.
TOTAL TIME WORKED TO STANDARD TIME	02-12	0.92	11.	0.92	0.
	01-21	0.87	5.	0.87	0.
	02-22	0.85	3.	0.85	0.
	02-21	0.84	1.	0.84	0.
(0.83)	01-12	0.83	-0.	0.83	0.
	02-11	0.82	-2.	0.82	0.
	01-22	0.77	-7.	0.77	0.
	01-11	0.77	-7.	0.77	0.

Figure 28

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

(2) COMPARISON REPORT: ANALYSIS OF COLLECTION COST INFORMATION REPORT IN DOLLARS
(3) PERIOD FOR WHICH DATA APPLIES (4/23/73 - 4/28/73)

(4) VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	(5) ORDERED BY COMPARISON WITH CITY YTD	(6) INDIVIDUAL YTD VALUE	(7) PERCENT DIFF FROM CITY YTD	(8) VALUE THIS PERIOD	(9) PERCENT DIFF FROM INDIVIDUAL YTD

(10) TOTAL COST PER DAY
(11) ( )

(1) This heading identifies the organization for which the information applies.

(2) Identifies the kind of information included in this section of the report. Comparison reports are provided only for the "Management Analysis Report".

(3) The period for which the information of the report applies.

---

(10) COST PER TON
(11) ( )

(4) Indicates the variable from the Cost Information Report that will be considered for analysis.

(5) Indicates the relative order of the organizational elements when ranked against the accumulative average (YTD = Year to Date) of the city as a whole. The organizational elements are ordered with the best performing element listed first.

---

(10) COST PER HOME PER WEEK
(11) ( )

(6) Indicates the actual value of the accumulative average (YTD) for the organizational elements and the variable considered.

(7) Indicates the percent difference (+ or -) the YTD of the organizational element differs from the YTD of the city as a whole.

(8) Indicates the value of the variable being considered for the period indicated and the organizational element listed under (5).

(9) Indicates the percent difference (+ or -) the value under (8) differs from the YTD value (6) of the organizational element listed under (5).

(10) Indicates the specific variable from the Cost Information Report that is considered for analysis.

(11) Indicates the YTD of the city against which the organizational elements in (5) will be ranked.

Figure 29

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF COLLECTION COST INFORMATION REPORT IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/21/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
TOTAL COST PER DAY (208.98)	01-11	207.60	-1.	207.60	0.
	02-11	208.51	-0.	208.51	0.
	02-22	208.51	-0.	208.51	0.
	01-22	208.56	-0.	208.56	0.
	01-12	208.58	-0.	208.58	0.
	01-21	208.73	-0.	208.73	0.
	02-21	208.80	-0.	208.80	0.
	02-12	213.26	2.	213.26	0.
COST PER TON (17.65)	01-21	16.67	-6.	16.67	0.
	02-12	16.68	-6.	16.68	0.
	01-11	16.69	-5.	16.69	0.
	01-22	17.69	0.	17.69	0.
	01-12	17.74	1.	17.74	0.
	02-11	17.92	2.	17.92	0.
	02-22	18.52	5.	18.52	0.
	02-21	19.73	12.	19.73	0.
COST PER HOME PER WEEK (0.44)	02-12	0.36	-18.	0.36	0.
	02-22	0.42	-5.	0.42	0.
	02-21	0.42	-5.	0.42	0.
	02-11	0.43	-2.	0.43	0.
	01-12	0.46	5.	0.46	0.
	01-21	0.47	7.	0.47	0.
	01-22	0.49	11.	0.49	0.
	01-11	0.51	16.	0.51	0.

Monthly COLMIS Reports. The monthly reports are presented in the same four-report format as the weekly reports. Explanations and examples are given (Figure 30 through 45).

The first level of each report summarizes the activities of each route (during the month) for a day of the week. For example, Figure 31 is a report on Mondays. Activities for each route supervisor are summed and averaged, and an overall average for the city is provided. These day of the week information reports make it possible to analyze the balance of workloads across the span of a collection cycle.

The second level (Figure 32, for example) summarizes an entire month's data for each route and then shows a sum and average for the route supervisor. The activities of the crews under different route supervisors appear on separate pages; thus, Figure 32 reflects only the organization under Route Supervisor 01-10.

The third level of the report (Figure 33, for example) is a management analysis report. It gives summary information for each route supervisor, each district, each area (not shown in example) and for the entire city.

The monthly Comparison Reports are identical to the weekly Comparison Reports and can be used in exactly the same manner (Figure 46-48).

Management Responsibility. Each organization has a distinct style of management. Sometimes it has been carefully planned. Other times it has just grown up around the personalities of those in charge. Whichever the case, the installation of COLMIS requires that this management style be defined. It is critical to the success of COLMIS that reports be used continuously and consistently.

There are reports geared for every level of management. For example, in ANY CITY, U.S.A., the first level detailed reports would be used by the route supervisors. The second level summary would be for the district managers. The Comparison Reports would be used by both the district managers and the route supervisors. The superintendent of sanitation would rely primarily on the third level, or Management Analysis Report. Any questions he would have would be resolved by explanations of the district managers or route supervisors, based on their analysis of their reports.

As management styles vary, so should the distribution of the COLMIS reports. If district managers are expected to function as a planning team with the general manager, it would be desirable for the Management Analysis Reports to be provided to them regularly. Or, if the district managers are inclined toward "grass roots" management, it would be necessary to provide the detailed reports to them, as well as the route supervisors.

It is also possible to limit or restrict the production of the COLMIS reports. Maybe after a period of time passes, management may determine that one or more levels of the reports are not always required. By use of an option card with the program (see Input Preparation under Data Processing Activity later in this chapter) report production can be selective. It is recommended, however, that all reports be produced and used until it is clearly evident that certain reports are not useful except on a less frequent basis.

It should be noted that COLMIS provides much information in a form that can easily be charted, or graphed, to show the progress of improvements or changes within the organization. Many managers find such graphs helpful in conveying the reasons for and effects of new policies and procedures not only to the men working for them, but also to city administrators who lack the time to review a set of detailed reports.

The COLMIS reports were designed to adapt easily to a wide variety of organizational structures. It is their purpose to be a management tool, to assist in the effort toward good, effective management. They are not, in themselves, a solution to any problem. The contribution of COLMIS is an objective report of collection activities and costs. It is for management to analyze this information and to use it to improve the organizational performance.

Figure 30

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) ROUTE INFORMATION REPORT
MONDAY (3) (4) PERIOD FOR WHICH DATA APPLIES (4/ 2/73 - 4/28/73)

(5) ROUTE NUMBER	(6) DAYS OF DATA USED	(7) AVERAGE VEHICLE SIZE (CU YD) AND TYPE	(8) AVERAGE CREW SIZE	(9) MOTOR POOL TO ROUTE (PER DAY) (MILES)	(9) (HOURS)	(10) COLLECTION OPERATION (PER DAY) (MILES)	(10) (HOURS)	(11) TRANSPORT OPERATION (PER DAY) (MILES)	(11) (HOURS)	(12) TIME TO COLLECT XPORT (HOURS)	(13) DOWN TIME (HOURS)	(14) LUNCH TIME (HOURS)	(15) WEIGHT PER DAY (POUNDS)	(15) (TONS)

THIS FORMAT IS USED ONLY IN THE MONTHLY PRINTOUT. IN THIS FORMAT ROUTE INFORMATION IS PROVIDED BY DAY OF THE WEEK.

(1) This heading identifies the organization for which the information applies.

(2) Identifies the kind of information included in this section of the report. There are four sections to each report. The first section consists of route information; the second section consists of collection information; the third section consists of cost information; and the fourth section is a summary of selected items of information from the previous three sections of the report.

(3) Indicates the day of the week for which the information applies.

(4) The period for which the information of the report applies.

(5) A 4 digit number that identifies each specific route and indicates its position in the organizational structure. For this management information system a route is defined to be the total efforts of a crew and vehicle for the period of one week.

(6) Number of days of data used in the period of the report. This number may be less than the number of working days in the period for two possible reasons: (a) Data were not provided for each working day; (b) Data were provided for each working day but because of errors in filling out the daily collection route information form the computer program rejected the data.

(7) Average size of vehicle used during the period and takes into consideration substitute vehicles of different sizes.

(8) Average size of crew used during the period.

(9), (10) & (11) Crew activities are viewed in three phases.
The first phase (9) begins with leaving the motor pool and ends with the first collection.
The second phase (10) represents the total collection effort irrespective of the number of loads. For each load the collection phase begins with the first collection and ends with the last collection to complete the load.
The third phase (11) represents the total transport effort and includes returning to the motor pool for the last load of the day. For each load the transport effort begins with the completion of the last collection to make a load and ends with the first collection of a new load or a return to the motor pool for the day.
For each phase the average miles traveled per day and the average time in hours per day is presented. The times and mileages exclude that time and mileage associated with down time and lunch time but does include coffee break time.

(12) Represents the average total time spent per day in performing the three phases of the crew activities. Down time and lunch time are excluded from this total time.

Figure 30 (con't)

(13) Represents the total time in hours that the vehicle was not operating in the period because of a breakdown problem.

(14) Represents the average time per day in hours that the crew spent for lunch.

(15) Represents the average net weight collected per day and is shown in pounds and tons.

Note: For each of the columns of (6) through (15) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

Figure 31

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

MONDAY

ROUTE NUMBER	DAYS OF DATA USED	AVERAGE VEHICLE SIZE (CU YD) AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY) (MILES)	MOTOR POOL TO ROUTE (PER DAY) (HOURS)	COLLECTION OPERATION (PER DAY) (MILES)	COLLECTION OPERATION (PER DAY) (HOURS)	TRANSPORT OPERATION (PER DAY) (MILES)	TRANSPORT OPERATION (PER DAY) (HOURS)	TIME TO ROUTE COLLECT XPORT (HOURS)	DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY (POUNDS)	WEIGHT PER DAY (TONS)
01-11	2.0	25-RL	4.0	5.0	0.3	8.0	5.1	22.5	1.3	6.7	----	0.7	27670.	13.8
01-12	1.0	25-RL	4.0	4.0	0.3	11.0	5.2	28.0	1.8	7.2	----	0.6	28720.	14.4
SUM	3.0			9.0	0.5	19.0	10.2	50.5	3.1	13.8	----		56390.	28.2
AVG	1.5	25-	4.0	4.7	0.3	9.0	5.1	24.3	1.5	6.8		0.6	28020.	14.0
YTD	1.5	25-	4.0	4.7	0.3	9.0	5.1	24.3	1.5	6.8		0.6	28020.	14.0
01-21	2.0	25-RL	4.0	3.5	0.2	9.5	4.8	23.5	1.3	6.4	----	0.6	23760.	11.9
01-22	2.0	25-RL	4.0	5.5	0.3	8.0	5.0	24.0	1.3	6.5	----	0.5	28670.	14.3
SUM	4.0			9.0	0.5	17.5	9.8	47.5	2.6	12.9	----		52430.	26.2
AVG	2.0	25-	4.0	4.5	0.2	8.8	4.9	23.8	1.3	6.4		0.5	26215.	13.1
YTD	2.0	25-	4.0	4.5	0.2	8.8	4.9	23.8	1.3	6.4		0.5	26215.	13.1
02-11	1.0	20-RL	4.0	3.0	0.3	10.0	5.8	35.0	1.8	7.8	----	0.5	33880.	16.9
02-12	2.0	20-RL	4.0	4.5	0.3	10.5	6.0	29.0	1.9	8.2	----	0.6	27440.	13.7
SUM	3.0			7.5	0.5	20.5	11.8	64.0	3.7	16.0	----		61320.	30.7
AVG	1.5	20-	4.0	4.0	0.3	10.3	5.9	31.0	1.9	8.1		0.6	29587.	14.8
YTD	1.5	20-	4.0	4.0	0.3	10.3	5.9	31.0	1.9	8.1		0.6	29587.	14.8
02-21	2.0	20-RL	4.0	5.0	0.3	9.0	4.9	24.0	1.2	6.3	----	0.5	22080.	11.0
02-22	2.0	20-RL	4.0	19.0	0.2	9.0	5.0	24.5	1.3	6.5	----	0.5	18370.	9.2
SUM	4.0			24.0	0.5	18.0	9.8	48.5	2.5	12.8	----		40450.	20.2
AVG	2.0	20-	4.0	12.0	0.3	9.0	4.9	24.3	1.3	6.4		0.5	20225.	10.1
YTD	2.0	20-	4.0	12.0	0.3	9.0	4.9	24.3	1.3	6.4		0.5	20225.	10.1

SUM AND AVERAGE FOR MONDAY

SUM	14.0			49.5	2.0	75.0	41.7	210.5	11.8	55.6	----		210590.	105.3
AVG	1.8	22-	4.0	6.6	0.3	9.2	5.2	25.6	1.4	6.9		0.6	25613.	12.8
YTD	1.8	22-	4.0	6.6	0.3	9.2	5.2	25.6	1.4	6.9		0.6	25613.	12.8

Figure 32

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		DAYS OF DATA USED	AVERAGE VEHICLE SIZE AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY)		COLLECTION OPERATION (PER DAY)		TRANSPORT OPERATION (PER DAY)		TIME TO ROUTE COLLECT XPORT (HOURS)	TOTAL DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY	
					(MILES)	(HOURS)	(MILES)	(HOURS)	(MILES)	(HOURS)				(POUNDS)	(TONS)
01-11		9.0	25-RL	4.0	4.4	0.2	7.6	4.6	23.1	1.4	6.2	----	0.6	25807.	12.9
01-12		8.0	24-RL	4.0	4.1	0.3	8.3	4.6	25.3	1.4	6.3	1.5	0.6	25035.	12.5
01-10	SUM	17.0			8.6	0.6	15.8	9.2	48.4	2.8	12.5	1.5		50842.	25.4
01-10	AVG	8.5	24-	4.0	4.3	0.3	7.9	4.6	24.1	1.4	6.3		0.6	25444.	12.7
01-10	YTD	8.5	24-	4.0	4.3	0.3	7.9	4.6	24.1	1.4	6.3		0.6	25444.	12.7

Figure 33

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		DAYS OF DATA USED	AVERAGE VEHICLE SIZE AND TYPE	AVERAGE CREW SIZE	MOTOR POOL TO ROUTE (PER DAY)		COLLECTION OPERATION (PER DAY)		TRANSPORT OPERATION (PER DAY)		TIME TO ROUTE COLLECT XPORT (HOURS)	TOTAL DOWN TIME (HOURS)	LUNCH TIME (HOURS)	WEIGHT PER DAY	
					(MILES)	(HOURS)	(MILES)	(HOURS)	(MILES)	(HOURS)				(POUNDS)	(TONS)
01-10	SUM	17.0			8.6	0.6	15.8	9.2	48.4	2.8	12.5	1.5		50842.	25.4
01-10	AVG	8.5	24-RL	4.0	4.3	0.3	7.9	4.6	24.1	1.4	6.3		0.6	25444.	12.7
01-10	YTD	8.5	24-RL	4.0	4.3	0.3	7.9	4.6	24.1	1.4	6.3		0.6	25444.	12.7
01-20	SUM	18.0			8.1	0.6	17.1	10.0	49.2	2.7	13.4	1.0		52070.	26.0
01-20	AVG	9.0	24-RL	4.0	4.1	0.3	8.6	5.0	24.6	1.4	6.7		0.5	26089.	13.0
01-20	YTD	9.0	24-RL	4.0	4.1	0.3	8.6	5.0	24.6	1.4	6.7		0.5	26089.	13.0
02-10	SUM	17.0			7.2	0.5	17.2	9.8	54.1	3.3	13.5	2.4		51010.	25.5
02-10	AVG	8.5	20-RL	4.0	3.6	0.2	8.5	4.9	27.0	1.6	6.7		0.5	25482.	12.7
02-10	YTD	8.5	20-RL	4.0	3.6	0.2	8.5	4.9	27.0	1.6	6.7		0.5	25482.	12.7
02-20	SUM	20.0			11.0	0.5	20.1	9.8	55.3	2.8	13.1	3.0		44711.	22.4
02-20	AVG	10.0	20-RL	4.0	5.5	0.3	10.0	4.9	27.6	1.4	6.6		0.5	22330.	11.2
02-20	YTD	10.0	20-RL	4.0	5.5	0.3	10.0	4.9	27.6	1.4	6.6		0.5	22330.	11.2
01-00	SUM	35.0			16.7	1.2	32.9	19.2	97.6	5.5	25.9	2.5		102912.	51.5
01-00	AVG	8.8	24-RL	4.0	4.2	0.3	8.2	4.8	24.4	1.4	6.5		0.6	25775.	12.9
01-00	YTD	8.8	24-RL	4.0	4.2	0.3	8.2	4.8	24.4	1.4	6.5		0.6	25775.	12.9
02-00	SUM	37.0			18.2	1.0	37.3	19.6	109.4	6.1	26.6	5.4		95721.	47.9
02-00	AVG	9.3	20-RL	4.0	4.6	0.2	9.4	4.9	27.4	1.5	6.6		0.5	23772.	11.9
02-00	YTD	9.3	20-RL	4.0	4.6	0.2	9.4	4.9	27.4	1.5	6.6		0.5	23772.	11.9
99-99	SUM	72.0			34.8	2.1	70.2	38.8	207.0	11.6	52.5	7.9		198633.	99.3
99-99	AVG	9.0	22-RL	4.0	4.4	0.3	8.8	4.8	25.9	1.4	6.6		0.5	24748.	12.4
99-99	YTD	9.0	22-RL	4.0	4.4	0.3	8.8	4.8	25.9	1.4	6.6		0.5	24748.	12.4

4.% OF DATA USED INCLUDED ESTIMATED MILEAGE.
91.% OF DATA USED.

Figure 34

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION INFORMATION REPORT
MONDAY (3) (4) PERIOD FOR WHICH DATA APPLIES (4/ 2/73 - 4/28/73)

(5) ROUTE NUMBER	(6) HOMES SERVED PER COLLECT	(7) WEIGHT PER HOME COLLECT (POUNDS)	(8) PERSONS SERVED PER COLLECT	(9) GENERATE PER PERSON PER DAY (POUNDS)	(10) COLLECT TIME PER HOME (MIN)	(11) COLLECT TIME PER 100LBS (MIN)	(12) COLLECT TIME TO TOTAL TIME	(13) TOTAL TIME WORKED TO STANDARD TIME	(14) LOADS PER DAY INCIN	LAND FILL	XFER STA	(15) WEIGHT PER CU YD 1ST LOAD (POUNDS)

THIS FORMAT IS USED ONLY IN THE MONTHLY PRINTOUT. IN THIS FORMAT ROUTE INFORMATION IS PROVIDED BY DAY OF THE WEEK.

(1), (2), (3), (4) & (5) Same as the corresponding items from the monthly Route Information Report.

(6) Indicates the average number of family units served per day.

(7) Indicates the average weight collected from each family unit on a collection day.

(8) Indicates the average number of persons served per collection day. This number is based on the number of family units served per day and the statistical average number of people per family unit in the area of the route.

(9) Indicates the average daily (seven days a week) quantity of solid waste generated per person and is based on the weight collected per home per day and the average number of people per family unit in the area of the route.

(10) Indicates the average time in minutes required to service one family unit.

(11) Indicates the average time in minutes required to collect 100 pounds of solid waste from the route.

(12) Indicates the proportion of time spent in collecting solid waste in comparison with the total time spent in going to the route, collecting and transporting waste, time spent on breakdowns and excess lunch time.

(13) Indicates the proportion of time spent in traveling to the route, collecting and transporting waste, time spent on breakdowns and excess lunch time in comparison with the time of the standard work day.

(14) Indicates the number of loads per day transported to the disposal sites listed. Any combination of three disposal sites can be listed.

(15) Indicates the degree of compaction being obtained on the first load with the equipment being used and the solid waste being collected. It is assumed that the first load in all cases is a full load.

Note: For each of the columns of (6) through (15) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

Figure 35

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

MONDAY

ROUTE NUMBER	HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY INCIN	LOADS PER DAY LAND FILL	LOADS PER DAY XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-11	450.	61.6	1375.	2.9	0.68	1.10	0.74	0.85	0.	2.	0.	675.
01-12	496.	57.9	1518.	2.7	0.63	1.08	0.71	0.91	0.	2.	0.	602.
SUM	946.		2893.						0.	4.	0.	
AVG	465.	60.3	1423.	2.8	0.66	1.09	0.73	0.87	0.	2.	0.	651.
YTD	465.	60.3	1423.	2.8	0.66	1.09	0.73	0.87	0.	2.	0.	651.
01-21	415.	57.3	1195.	2.8	0.70	1.22	0.75	0.81	0.	2.	0.	532.
01-22	469.	61.2	1349.	3.0	0.64	1.05	0.77	0.81	0.	2.	0.	654.
SUM	884.		2544.						0.	4.	0.	
AVG	442.	59.3	1272.	2.9	0.67	1.13	0.76	0.81	0.	2.	0.	593.
YTD	442.	59.3	1272.	2.9	0.67	1.13	0.76	0.81	0.	2.	0.	593.
02-11	496.	68.3	1518.	3.2	0.71	1.03	0.74	0.98	0.	3.	0.	713.
02-12	585.	46.9	1790.	2.2	0.62	1.31	0.72	1.04	0.	3.	0.	614.
SUM	1081.		3308.						0.	6.	0.	
AVG	555.	53.3	1699.	2.5	0.64	1.21	0.73	1.02	0.	3.	0.	647.
YTD	555.	53.3	1699.	2.5	0.64	1.21	0.73	1.02	0.	3.	0.	647.
02-21	417.	52.9	1201.	2.6	0.70	1.32	0.76	0.80	0.	2.	0.	577.
02-22	396.	46.4	1140.	2.3	0.75	1.62	0.76	0.81	0.	2.	0.	481.
SUM	813.		2341.						0.	4.	0.	
AVG	407.	49.8	1171.	2.5	0.73	1.46	0.76	0.81	0.	2.	0.	529.
YTD	407.	49.8	1171.	2.5	0.73	1.46	0.76	0.81	0.	2.	0.	529.

SUM AND AVERAGE FOR MONDAY

SUM	3723.		11087.						0.	18.	0.	
AVG	461.	55.6	1369.	2.7	0.67	1.21	0.75	0.87	0.	2.	0.	601.
YTD	461.	55.6	1369.	2.7	0.67	1.21	0.75	0.87	0.	2.	0.	601.

Figure 36

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY INCIN	LOADS PER DAY LAND FILL	LOADS PER DAY XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-11		427.	60.5	1306.	2.8	0.65	1.08	0.73	0.79	0.	2.	0.	621.
01-12		456.	54.9	1397.	2.6	0.60	1.09	0.69	0.82	0.	2.	0.	593.
01-10	SUM	883.		2703.						0.	4.	0.	
01-10	AVG	441.	57.7	1349.	2.7	0.63	1.09	0.71	0.81	0.	2.	0.	608.
01-10	YTD	441.	57.7	1349.	2.7	0.63	1.09	0.71	0.81	0.	2.	0.	608.

Figure 37

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	PERSONS SERVED PER COLLECT DAY	GENERATE PER PERSON PER DAY (POUNDS)	COLLECT TIME PER HOME (MIN)	COLLECT TIME PER 100LBS (MIN)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	LOADS PER DAY INCIN	LOADS PER DAY LAND FILL	LOADS PER DAY XFER STA	WEIGHT PER CU YD 1ST LOAD (POUNDS)
01-10	SUM	883.		2703.						0.	4.	0.	
01-10	AVG	441.	57.7	1349.	2.7	0.63	1.09	0.71	0.81	0.	2.	0.	608.
01-10	YTD	441.	57.7	1349.	2.7	0.63	1.09	0.71	0.81	0.	2.	0.	608.
01-20	SUM	879.		2532.						0.	4.	0.	
01-20	AVG	440.	59.4	1266.	2.9	0.68	1.15	0.74	0.85	0.	2.	0.	599.
01-20	YTD	440.	59.4	1266.	2.9	0.68	1.15	0.74	0.85	0.	2.	0.	599.
02-10	SUM	1078.		3297.						0.	5.	0.	
02-10	AVG	536.	47.6	1640.	2.2	0.55	1.15	0.70	0.86	0.	2.	0.	583.
02-10	YTD	536.	47.6	1640.	2.2	0.55	1.15	0.70	0.86	0.	2.	0.	583.
02-20	SUM	1006.		2897.						0.	4.	0.	
02-20	AVG	503.	44.4	1449.	2.2	0.58	1.32	0.73	0.84	0.	2.	0.	551.
02-20	YTD	503.	44.4	1449.	2.2	0.58	1.32	0.73	0.84	0.	2.	0.	551.
01-00	SUM	1762.		5234.						0.	8.	0.	
01-00	AVG	440.	58.6	1307.	2.8	0.66	1.12	0.73	0.83	0.	2.	0.	603.
01-00	YTD	440.	58.6	1307.	2.8	0.66	1.12	0.73	0.83	0.	2.	0.	603.
02-00	SUM	2084.		6195.						0.	9.	0.	
02-00	AVG	518.	45.9	1539.	2.2	0.57	1.23	0.72	0.85	0.	2.	0.	565.
02-00	YTD	518.	45.9	1539.	2.2	0.57	1.23	0.72	0.85	0.	2.	0.	565.
99-99	SUM	3846.		11429.						0.	17.	0.	
99-99	AVG	480.	51.5	1426.	2.5	0.61	1.18	0.72	0.84	0.	2.	0.	586.
99-99	YTD	480.	51.5	1426.	2.5	0.61	1.18	0.72	0.84	0.	2.	0.	586.

Figure 38

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION COST INFORMATION IN DOLLARS
MONDAY (3) (4) PERIOD FOR WHICH DATA APPLIES (4/ 2/73 - 4/28/73)

(5) ROUTE NUMBER	(6) COST TO ROUTE	(7) COST TO COLLECT	(8) COST TO XPORT	(9) EQUIP-MENT COST	(10) MANPOWER COST	(11) TOTAL COST	(12) BREAK-DOWN COST (MANPWR)	(13) INCEN-TIVE COST	(14) OVER-TIME COST	(15) CUST PER TON	(16) COST PER HOME PER WEEK	(16) COST PER HOME PER YEAR

THIS FORMAT IS USED ONLY IN THE MONTHLY PRINTOUT. IN THIS FORMAT ROUTE INFORMATION IS PROVIDED BY DAY OF THE WEEK.

(1), (2), (3), (4),& (5) Same as the corresponding items from the monthly Route Information Report.

(6) Indicates the sum of the equipment and personnel costs per day to travel from the motor pool to the first collection. These costs are based on the time required to perform this operation.

(7) Indicates the sum of the equipment and personnel costs per day to complete the total collection phase of the effort. These costs are based on the time required to complete the collection effort.

(8) Indicates the sum of the equipment and personnel costs per day to complete the transport phase of the effort. These costs are based on the time required to complete the transport effort.

(9) Indicates the total cost of operating the equipment per day and includes depreciation, maintenance, and daily consumable costs.

(10) Indicates the total personnel costs per day. The personnel costs will include the time to route, collect, transport, and overtime costs. All time worked in excess of the normally paid workday, including time associated with a breakdown and excess lunch time, will be used to compute overtime costs. The personnel costs can include the costs of labor fringe benefits and personnel overhead.

(11) Indicates the total daily equipment and personnel costs per day. This total cost is also the sum of the costs to go to the route, to collect and to transport.

(12) Indicates the total personnel operating costs of the breakdowns in the period based on the daily manpower costs and the time required to solve the breakdown problems. This cost does NOT include the actual parts and maintenance labor costs associated with correcting the breakdown problem.

(13) Indicates the daily cost of the crew which is paid when the crew is not working a full standard day.

(14) Indicates the daily cost of the crew which is paid when the crew works longer than the standard day.

(15) Indicates the total equipment and personnel costs required to collect and transport one ton of solid waste to the disposal point.

(16) Indicates the total equipment and personnel costs required to service one family unit per week and per year.

Note: For each of the columns of (6) through (16) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

Figure 39

ANY CITY, U.S.A.

MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION COST INFORMATION IN DOLLARS

MONDAY — PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER	COST TO ROUTE	COST TO COLLECT	COST TO XPORT	EQUIP-MENT COST	MANPOWER COST	TOTAL COST	BREAK-DOWN COST (MANPWR)	INCEN-TIVE COST	OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-11	7.80	158.50	41.57	31.47	176.40	207.87	0.0	25.72	0.0	15.02	0.46	23.92
01-12	7.28	150.36	50.93	32.17	176.40	208.57	0.0	16.54	0.0	14.52	0.42	21.84
SUM	15.07	308.86	92.50	63.64	352.80	416.44	0.0	42.26	0.0			
AVG	7.61	155.65	44.84	31.70	176.40	208.10				14.85	0.45	23.40
YTD	7.61	155.65	44.84	31.70	176.40	208.10				14.85	0.45	23.40
01-21	6.78	157.27	43.39	31.04	176.40	207.44	0.0	33.99	0.0	17.46	0.50	26.00
01-22	7.94	158.86	39.72	30.12	176.40	206.52	0.0	33.07	0.0	14.41	0.44	22.88
SUM	14.72	316.14	83.10	61.16	352.80	413.96	0.0	67.07	0.0			
AVG	7.37	158.08	41.53	30.58	176.40	206.93				15.79	0.47	24.44
YTD	7.37	158.08	41.53	30.58	176.40	206.98				15.79	0.47	24.44
02-11	6.65	155.10	46.53	31.88	176.40	208.23	0.0	3.67	0.0	12.30	0.42	21.84
02-12	7.55	155.39	49.64	33.33	179.25	212.58	0.0	0.0	2.85	15.49	0.36	18.72
SUM	14.20	310.49	96.17	65.21	355.65	420.85	0.0	3.67	2.85			
AVG	7.24	154.93	48.51	32.85	177.82	210.67				14.24	0.38	19.76
YTD	7.24	154.93	48.51	32.85	177.82	210.67				14.24	0.38	19.76
02-21	9.63	160.98	38.53	32.74	176.40	209.14	0.0	35.83	0.0	18.94	0.50	26.00
02-22	6.70	159.49	42.89	32.68	176.40	209.08	0.0	33.07	0.0	22.76	0.53	27.56
SUM	16.33	320.47	81.41	65.42	352.80	418.22	0.0	68.91	0.0			
AVG	8.15	160.23	40.74	32.71	176.40	209.11				20.68	0.51	26.52
YTD	8.15	160.23	40.74	32.71	176.40	209.11				20.68	0.51	26.52

SUM AND AVERAGE FOR MONDAY

SUM	60.33	1255.96	353.19	255.43	1414.05	1669.48	0.0	181.91	2.85			
AVG	7.59	157.32	43.76	31.91	176.76	208.67				16.29	0.45	23.40
YTD	7.59	157.32	43.76	31.91	176.76	208.67				16.29	0.45	23.40

Figure 40

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION COST INFORMATION IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		COST TO ROUTE PER DAY	COST TO COLLECT PER DAY	COST TO XPORT PER DAY	EQUIP-MENT COST PER DAY	MANPOWER COST PER DAY	TOTAL COST PER DAY	TOTAL BREAK-DOWN COST (MANPWR)	TOTAL INCEN-TIVE COST	TOTAL OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-11		7.69	154.18	45.85	31.32	176.40	207.72	0.0	338.10	0.0	16.10	0.49	25.48
01-12		10.69	151.06	46.56	31.37	176.93	208.31	38.72	264.60	4.27	16.64	0.46	23.92
01-10	SUM	18.38	305.23	92.41	62.69	353.33	416.03	38.72	602.70	4.27			
01-10	AVG	9.11	152.70	46.19	31.35	176.65	208.00				16.35	0.47	24.44
01-10	YTD	9.11	152.70	46.19	31.35	176.65	208.00				16.35	0.47	24.44

Figure 41

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION COST INFORMATION IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		COST TO ROUTE PER DAY	COST TO COLLECT PER DAY	COST TO XPORT PER DAY	EQUIP-MENT COST PER DAY	MANPOWER COST PER DAY	TOTAL COST PER DAY	TOTAL BREAK-DOWN COST (MANPWR)	TOTAL INCEN-TIVE COST	TOTAL OVER-TIME COST	COST PER TON	COST PER HOME PER WEEK	COST PER HOME PER YEAR
01-10	SUM	18.38	305.23	92.41	62.69	353.33	416.03	38.72	602.70	4.27			
01-10	AVG	9.11	152.70	46.19	31.35	176.65	208.00				16.35	0.47	24.44
01-10	YTD	9.11	152.70	46.19	31.35	176.65	208.00				16.35	0.47	24.44
01-20	SUM	19.40	311.61	84.95	62.46	353.51	415.97	23.59	503.47	6.41			
01-20	AVG	9.66	155.81	42.52	31.23	176.76	207.98				15.94	0.47	24.44
01-20	YTD	9.66	155.81	42.52	31.23	176.76	207.99				15.94	0.47	24.44
02-10	SUM	14.32	303.67	102.13	65.36	354.76	420.12	65.18	442.84	15.67			
02-10	AVG	7.18	151.73	51.06	32.65	177.32	209.97				16.48	0.39	20.28
02-10	YTD	7.18	151.73	51.06	32.65	177.32	209.97				16.48	0.39	20.28
02-20	SUM	16.25	312.58	89.32	65.35	352.80	418.15	87.79	549.41	0.0			
02-20	AVG	8.10	156.21	44.76	32.67	176.40	209.07				18.73	0.42	21.84
02-20	YTD	8.10	156.21	44.76	32.67	176.40	209.07				18.73	0.42	21.84
01-00	SUM	37.79	616.84	177.36	125.15	706.85	832.00	62.30	1106.17	10.69			
01-00	AVG	9.40	154.35	44.24	31.29	176.70	207.99				16.14	0.47	24.44
01-00	YTD	9.40	154.35	44.24	31.29	176.71	207.99				16.14	0.47	24.44
02-00	SUM	30.58	616.25	191.44	130.71	707.56	838.27	152.98	992.25	15.67			
02-00	AVG	7.67	154.12	47.69	32.66	176.82	209.48				17.62	0.40	20.80
02-00	YTD	7.67	154.12	47.69	32.66	176.82	209.48				17.62	0.40	20.80
99-99	SUM	68.36	1233.09	368.81	255.86	1414.41	1670.26	215.28	2098.42	26.36			
99-99	AVG	8.50	154.23	46.03	31.99	176.76	208.76				16.87	0.43	22.36
99-99	YTD	8.50	154.23	46.03	31.99	176.77	208.76				16.87	0.43	22.36

Figure 42

(1) ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

(2) COLLECTION SYSTEM OPERATION SUMMARY
MONDAY (3) (4) PERIOD FOR WHICH DATA APPLIES (4/ 2/73 - 4/28/73)

(5) ROUTE NUMBER	(6) HOMES SERVED PER COLLECT DAY	(7) WEIGHT PER HOME COLLECT DAY (POUNDS)	(8) WEIGHT PER DAY (TONS)	(9) COLLECT TIME PER HOME (MIN)	(10) TIME TO ROUTE COLLECT XPORT (HOURS)	(11) COLLECT TIME TO TOTAL TIME WORKED	(12) TOTAL TIME WORKED TO STANDARD TIME	(13) COST PER TON ACTUAL	(13) PERCENT DIFF FROM AVERAGE	(14) COST PER HOME PER WEEK ACTUAL	(14) PERCENT DIFF FROM AVERAGE

THIS FORMAT IS USED ONLY IN THE MONTHLY PRINTOUT. IN THIS FORMAT ROUTE INFORMATION IS PROVIDED BY DAY OF THE WEEK.

(1), (2), (3), (4) & (5) Same as the corresponding items from the monthly Route Information Report.

(6) From the Collection Information Report.

(7) From the Collection Information Report.

(8) From the Route Information Report.

(9) From the Collection Information Report.

(10) From the Route Information Report.

(11) From the Collection Information Report.

(12) From the Collection Information Report.

(13) From the Cost Information Report. The percent difference from the city accumulative (YTD) average is also provided.

(14) From the Cost Information Report. The percent difference from the city accumulative (YTD) average is also provided.

Note: For each of the columns of (6) through (14) a sum, average, and accumulative average (YTD = Year to Date, the accumulative average) is provided where this is meaningful.

Figure 43

ANY CITY, U.S.A.

MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION SYSTEM OPERATION SUMMARY

MONDAY — PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/20/73)

ROUTE NUMBER	HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-11	450.	61.6	13.8	0.68	6.7	0.74	0.85	15.02	-8.	0.46	2.
01-12	496.	57.9	14.4	0.63	7.2	0.71	0.91	14.52	-11.	0.42	-7.
SUM	946.		28.2		13.8						
AVG	465.	60.3	14.0	0.66	6.8	0.73	0.87	14.85	-9.	0.45	0.
YTD	465.	60.3	14.0	0.66	6.8	0.73	0.87	14.85	-9.	0.45	0.
01-21	415.	57.3	11.9	0.70	6.4	0.75	0.81	17.46	7.	0.50	11.
01-22	469.	61.2	14.3	0.64	6.5	0.77	0.81	14.41	-12.	0.44	-2.
SUM	884.		26.2		12.9						
AVG	442.	59.3	13.1	0.67	6.4	0.76	0.81	15.79	-3.	0.47	4.
YTD	442.	59.3	13.1	0.67	6.4	0.76	0.81	15.79	-3.	0.47	4.
02-11	496.	68.3	16.9	0.71	7.8	0.74	0.98	12.30	-25.	0.42	-7.
02-12	585.	46.9	13.7	0.62	8.2	0.72	1.04	15.49	-5.	0.36	-20.
SUM	1081.		30.7		16.0						
AVG	555.	53.3	14.8	0.64	8.1	0.73	1.02	14.24	-13.	0.38	-16.
YTD	555.	53.3	14.8	0.64	8.1	0.73	1.02	14.24	-13.	0.38	-16.
02-21	417.	52.9	11.0	0.70	6.3	0.76	0.80	18.94	16.	0.50	11.
02-22	396.	46.4	9.2	0.75	6.5	0.76	0.81	22.76	40.	0.53	18.
SUM	813.		20.2		12.8						
AVG	407.	49.8	10.1	0.73	6.4	0.76	0.81	20.68	27.	0.51	13.
YTD	407.	49.8	10.1	0.73	6.4	0.76	0.81	20.68	27.	0.51	13.

SUM AND AVERAGE FOR MONDAY

SUM	3723.		105.3		55.6						
AVG	461.	55.6	12.8	0.67	6.9	0.75	0.87	16.29	0.	0.45	0.
YTD	461.	55.6	12.8	0.67	6.9	0.75	0.87	16.29	0.	0.45	0.

Figure 44

ANY CITY, U.S.A.

MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION

COLLECTION SYSTEM OPERATION SUMMARY

PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-11		427.	60.5	12.9	0.65	6.2	0.73	0.79	16.10	-5.	0.49	14.
01-12		456.	54.9	12.5	0.60	6.3	0.69	0.82	16.64	-1.	0.46	7.
01-10	SUM	883.		25.4		12.5						
01-10	AVG	441.	57.7	12.7	0.63	6.3	0.71	0.81	16.35	-3.	0.47	9.
01-10	YTD	441.	57.7	12.7	0.63	6.3	0.71	0.81	16.35	-3.	0.47	9.

Figure 45

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COLLECTION SYSTEM OPERATION SUMMARY
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

ROUTE NUMBER		HOMES SERVED PER COLLECT DAY	WEIGHT PER HOME PER COLLECT DAY (POUNDS)	WEIGHT PER DAY (TONS)	COLLECT TIME PER HOME (MIN)	TIME TO ROUTE COLLECT XPORT (HOURS)	COLLECT TIME TO TOTAL TIME WORKED	TOTAL TIME WORKED TO STANDARD TIME	COST PER TON ACTUAL	COST PER TON PERCENT DIFF FROM AVERAGE	COST PER HOME PER WEEK ACTUAL	COST PER HOME PER WEEK PERCENT DIFF FROM AVERAGE
01-10	SUM	883.		25.4		12.5						
01-10	AVG	441.	57.7	12.7	0.63	6.3	0.71	0.81	16.35	-3.	0.47	9.
01-10	YTD	441.	57.7	12.7	0.63	6.3	0.71	0.81	16.35	-3.	0.47	9.
01-20	SUM	879.		26.0		13.4						
01-20	AVG	440.	59.4	13.0	0.68	6.7	0.74	0.85	15.94	-5.	0.47	9.
01-20	YTD	440.	59.4	13.0	0.68	6.7	0.74	0.85	15.94	-5.	0.47	9.
02-10	SUM	1078.		25.5		13.5						
02-10	AVG	536.	47.6	12.7	0.55	6.7	0.70	0.86	16.48	-2.	0.39	-9.
02-10	YTD	536.	47.6	12.7	0.55	6.7	0.70	0.86	16.48	-2.	0.39	-9.
02-20	SUM	1006.		22.4		13.1						
02-20	AVG	503.	44.4	11.2	0.58	6.6	0.73	0.84	18.73	11.	0.42	-2.
02-20	YTD	503.	44.4	11.2	0.58	6.6	0.73	0.84	18.73	11.	0.42	-2.
01-00	SUM	1762.		51.5		25.9						
01-00	AVG	440.	58.6	12.9	0.66	6.5	0.73	0.83	16.14	-4.	0.47	9.
01-00	YTD	440.	58.6	12.9	0.66	6.5	0.73	0.83	16.14	-4.	0.47	9.
02-00	SUM	2084.		47.9		26.6						
02-00	AVG	518.	45.9	11.9	0.57	6.6	0.72	0.85	17.62	4.	0.40	-7.
02-00	YTD	518.	45.9	11.9	0.57	6.6	0.72	0.85	17.62	4.	0.40	-7.
99-99	SUM	3846.		99.3		52.5						
99-99	AVG	480.	51.5	12.4	0.61	6.6	0.72	0.84	16.87	-0.	0.43	0.
99-99	YTD	480.	51.5	12.4	0.61	6.6	0.72	0.84	16.87	0.	0.43	0.

Figure 46

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF ROUTE INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
AVERAGE TIME COLLECTING PER DAY (HOURS) (4.8)	02-12	5.1	5.	5.1	0.
	01-21	5.1	5.	5.1	0.
	02-22	5.1	4.	5.1	0.
	01-22	4.9	1.	4.9	0.
	02-21	4.7	-2.	4.7	0.
	02-11	4.7	-4.	4.7	0.
	01-11	4.6	-4.	4.6	0.
	01-12	4.6	-6.	4.6	0.
TOTAL TIME TO ROUTE, COLLECT, TRANSPORT (HOURS) (6.6)	02-12	7.0	7.	7.0	0.
	02-22	6.9	4.	6.9	0.
	01-21	6.8	4.	6.8	0.
	01-22	6.6	-0.	6.6	0.
	02-11	6.5	-1.	6.5	0.
	01-12	6.3	-4.	6.3	0.
	02-21	6.3	-5.	6.3	0.
	01-11	6.2	-5.	6.2	0.
AVERAGE WEIGHT COLLECTED PER DAY (TONS) (12.4)	01-21	13.1	6.	13.1	0.
	02-12	12.9	5.	12.9	0.
	01-22	12.9	4.	12.9	0.
	01-11	12.9	4.	12.9	0.
	02-11	12.6	2.	12.6	0.
	01-12	12.5	1.	12.5	0.
	02-22	11.3	-8.	11.3	0.
	02-21	11.0	-11.	11.0	0.

Figure 47

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF COLLECTION INFORMATION REPORT
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
HOMES SERVED PER DAY (480.)	02-12	588.	22.	588.	0.
	02-22	508.	6.	508.	0.
	02-21	499.	4.	499.	0.
	02-11	490.	2.	490.	0.
	01-12	456.	-5.	456.	0.
	01-21	444.	-8.	444.	0.
	01-22	435.	-9.	435.	0.
	01-11	427.	-11.	427.	0.
COLLECTION TIME PER HOME (MINUTES) (0.61)	02-12	0.52	-14.	0.52	0.
	02-21	0.57	-6.	0.57	0.
	02-11	0.57	-6.	0.57	0.
	02-22	0.60	-1.	0.60	0.
	01-12	0.60	-1.	0.60	0.
	01-11	0.65	8.	0.65	0.
	01-22	0.68	12.	0.68	0.
	01-21	0.69	14.	0.69	0.
COLLECTION TIME TO TOTAL TIME WORKED (0.72)	01-22	0.75	4.	0.75	0.
	02-22	0.73	2.	0.73	0.
	01-21	0.73	1.	0.73	0.
	01-11	0.73	1.	0.73	0.
	02-21	0.72	-0.	0.72	0.
	02-11	0.70	-2.	0.70	0.
	02-12	0.70	-3.	0.70	0.
	01-12	0.69	-4.	0.69	0.
TOTAL TIME WORKED TO STANDARD TIME (0.84)	02-12	0.91	8.	0.91	0.
	01-21	0.87	4.	0.87	0.
	02-22	0.86	3.	0.86	0.
	02-11	0.83	-1.	0.83	0.
	01-12	0.82	-2.	0.82	0.
	02-21	0.82	-2.	0.82	0.
	01-22	0.82	-2.	0.82	0.
	01-11	0.79	-5.	0.79	0.

Figure 48

ANY CITY, U.S.A.
MANAGEMENT INFORMATION SYSTEM FOR SOLID WASTE COLLECTION
MANAGEMENT ANALYSIS REPORT

COMPARISON REPORT: ANALYSIS OF COLLECTION COST INFORMATION REPORT IN DOLLARS
PERIOD FOR WHICH DATA APPLIES (4/16/73 - 4/28/73)

VARIABLE UNDER CONSIDERATION (CITY YTD VALUE)	ORDERED BY COMPARISON WITH CITY YTD	INDIVIDUAL YTD VALUE	PERCENT DIFF FROM CITY YTD	VALUE THIS PERIOD	PERCENT DIFF FROM INDIVIDUAL YTD
TOTAL COST PER DAY	01-11	207.72	-0.	207.72	0.
	01-21	207.84	-0.	207.84	0.
	01-22	208.13	-0.	208.13	0.
	01-12	208.31	-0.	208.31	0.
(208.76)	02-11	208.51	-0.	208.51	-0.
	02-21	208.93	0.	208.93	0.
	02-22	209.21	0.	209.21	0.
	02-12	211.61	1.	211.61	0.
COST PER TON	01-21	15.83	-6.	15.83	0.
	01-11	16.10	-5.	16.10	0.
	01-22	16.12	-4.	16.12	0.
	02-12	16.35	-3.	16.35	0.
(16.87)	02-11	16.60	-2.	16.60	-0.
	01-12	16.64	-1.	16.64	0.
	02-22	18.44	9.	18.44	0.
	02-21	18.98	12.	18.98	0.
COST PER HOME PER WEEK (0.43)	02-12	0.36	-16.	0.36	0.
	02-22	0.41	-5.	0.41	0.
	02-21	0.42	-2.	0.42	0.
	02-11	0.43	0.	0.43	0.
	01-12	0.46	7.	0.46	0.
	01-21	0.47	9.	0.47	0.
	01-22	0.48	12.	0.48	0.
	01-11	0.49	14.	0.49	0.

Collection Crew Activity

Completion of the Daily Collection Route Information Form.

The people most directly affected by COLMIS are the collection crews. Management will be using the system's reports not only to evaluate the men's performance but to balance work loads among crews throughout the city's collection cycle. It is the monitoring of their daily activities that provides the data needed to produce the system's reports. Usually it will be the collection vehicle driver's responsibility to accurately complete the Daily Collection Route Information form. Their understanding of the form and their cooperation are critical. The management reports are only as valid as the input from the drivers. Often, to make it simpler for the drivers and to insure greater accuracy the information at the top of the daily form is filled out before it is given to the drivers, usually by the foreman.

Daily Collection Route Information Form. These forms were designed to simplify, as much as possible, the task of recording the necessary information on crew activities. One form is filled out for each crew each day. Following is a discussion of specific items on the form (Figure 49). A completed form is also shown (Figure 50).

Route--the route number assigned to this crew according to the numbering scheme adopted. See discussion of route numbering systems earlier in this chapter.

Date--today's date, preferably in six numerical digits. This date should correspond to the day. (See explanation of Day, below).

Day--Usual day of the week this route is collected. At times around holidays and snow emergencies, routes are often not collected on their usual days. Because the monthly reports summarize by day of the week to provide area planning data, reporting the actual collection day rather than the normal one will cause inappropriate data combinations in the monthly reports. Reporting of the normal, rather than the actual, will cause a less accurate report of overtime cost. Since the cost reports are management guides and approximations rather than cost accounting reports, it is generally recognized that sacrificing cost accuracy is less significant than the mixing of area data. In the case of one day's collection (say Friday) that spreads over two days (overtime on Saturday), it must be remembered that only one data sheet can be submitted for each crew each day. Hence, this must be reported as it actually happened on Friday and Saturday.

Crew Size--includes driver and all helpers assigned to one vehicle. If the number of helpers varies during the course of a day, a standard procedure should be adopted counting the size of the crew that either begins in the morning or ends in the afternoon. Consistency of recording will minimize the impact of the variance. Crew size is used for computing manpower costs.

Vehicle No.--the vehicle number assigned to the truck used this day. A discussion of vehicle number is contained in Volume II. The vehicle number is used to ascertain the proper costs of equipment for this day.

Fuel--the number of gallons of gasoline or diesel fuel added this day. Fuel costs are included in daily equipment cost on the reports. If individual fuel usages are not available, the cost of average usage can be included in the background data on daily maintenance cost. See Volume II.

Oil--the number of quarts of engine (not hydraulic) oil added this day. Oil cost is included in daily equipment cost on the reports. If individual oil usages are not available, the cost of average usage can be included in the background data on daily maintenance cost. See Volume II.

Number of Homes Served--either an actual count of homes served each day, or a standard number for the daily route (based either on an actual count or census maps) if the crew is consistently assigned to the same geographical area is required. The standard number concept is probably a more reliable approach. Drivers are too busy working to be able to keep accurate house counts, even if a mechanical counter is used. If the standard number method is used and for some reason the route cannot be completed, an estimation of the homes not served can be subtracted from the standard number. A home can be defined either as a dwelling unit or a stop made. Thus a four-family apartment building can be counted either as four or as one. It is important to be consistent and to remember this definition when using the information in the reports.

Time and Miles-- these entries record the starting and stopping points of each major collection function throughout the day.

"Leave Motor Pool" notes the time and odometer reading as the truck starts to leave the motor pool to proceed to the collection route.

"Start Collection" notes the time and odometer reading when the crew arrives on the route for the first time of the day. If the crew goes to the discharge point before the route, this entry is not used. First arrival on the route is shown on the first "Arrive Back on Route" line. See Figure 51.

"Leave Route" notes the time and odometer reading when the crew leaves the route to go either to the discharge point or back to the garage at the end of the day.

"Arrive Back on Route" notes the time and odometer reading when the crew returns to the route from the discharge point.

"Arrive at Motor Pool" notes the time and odometer reading when the crew returns to the motor pool from either the route or the discharge point at the end of the working day.

"Lunch - Start and Finish" notes times and odometer readings for the beginning and end of the lunch break. These entries are independent of all entries above. In other words, a "leave route" entry is not required to indicate a departure for lunch. If lunch is taken while on the route, the entries reflect the time collection activities cease and then resume. If lunch is taken while on the way to or from the disposal point, the entries reflect the time transport activities cease and then resume. This may or may not include driving done specifically to get to a place to eat. If no extra driving is done, the mileage entries may be made identical or left blank. If no lunch is taken these time and mile entries should be left entirely blank. If lunch is taken after the final return to the motor pool either the entries should be left blank, or the "arrive at motor pool" should be changed to match the finish of lunch. The computer program automatically subtracts time and mileage from whatever function (except breakdown) was interrupted by lunch.

"Breakdown--Start and Finish" entries work much like the lunch entries. If a minor breakdown occurs, that is if the truck can be fixed (either on the route or at another location) and does not need to be replaced, the time when the breakdown occurred and the time activities could resume are recorded. The entries are independent of all entries above. If no driving to a place of repair was required, the mileage entries can either be made identical or left blank. If a breakdown occurs at the same time as lunch such that the time is less than that taken for lunch, no recording of breakdown time and miles should be made. If lunch is taken during a breakdown (which is longer than the lunch time taken) the portion taken as lunch should not be recorded under breakdown. If, for example, a breakdown occurs from 12:00 to 12:30 and lunch is taken from 12:00 to 12:30,

lunch is recorded as 12:00 to 12:30 and breakdown as 12:30 to 1:00. The computer program automatically subtracts the time and mileage from whatever function (except lunch) was interrupted by the breakdown.

"Breakdown Problem." Circle the appropriate description for the breakdown which occurred. This entry is for manual review and is not inputted to the computer program.

"Vehicle Replaced" time entry is to record the time a replacement vehicle was substituted for the assigned vehicle as a result of a major breakdown. Any entry in this block will cause all the data for this route on this day to be rejected.

When an odometer is broken, mileage can be estimated and recorded in a cumulative fashion starting with zero miles for "leave motor pool." Figure 52 illustrates how this process works.

Weights and Discharge Point. Each time the truck arrives at the disposal point, it is weighed and the weight (either gross or net) is recorded in the "at discharge point" weight block. If gross weights are used, vehicle tare weight must be included in vehicle information (See Volume II). If weights are not available, approximations based on volume can be used. Periodically compaction densities (weight per cubic yard) should be checked by using scales to obtain the weights needed in the evaluation. This will lead to more accurate weight estimates and at the same time point up any problems with compaction equipment. When using estimations, it is important to be consistent and to remember this fact when using the information of the reports for planning. These figures would provide a guideline rather than a factual picture of solid waste generation. If it is totally unfeasible to record weights, the entries may be left blank, but all information based on weight in the management report will not be calculated. A discharge point code is also entered to identify the disposal point. Up to three disposal locations can be accommodated. A description of the codes appears in the lower left hand corner of the daily form and can be adapted to fit any city. The computer program requires that at least one trip to a disposal point be made or else the data will be rejected.

Data Verified By. All forms should be reviewed for validity of information and to assure that all necessary elements on the form are filled out. The following elements must be recorded on each form:

Route Number

Date

Day

Crew Size

Vehicle Number

Number of Homes Served

Leave Motor Pool

If crew goes from motor pool to route (See Figure 50):

Start Collection line

Leave Route line

First At-Discharge Point line

If crew goes from motor pool to discharge point (see Figure 52):

First At-Discharge Point line

First Arrive Back on Route line

Leave Route line

Arrive at Motor Pool

For each "arrive on route" entry, the following "leave route" entry must be completed. Likewise, for every "leave route" entry, the preceding "arrive on route" entry (where both are completed) a trip to the disposal point must be indicated by recording weight and discharge point code. A discharge code must be present for each trip to the disposal point.

Absence of any of these elements causes a rejection of the data during the edit stage of the COLMIS computer program.

Figure 50 depicts a normal day's activities.

Figure 51 illustrates recording of mileage when odometer is broken.

Figure 52 shows a vehicle which begins the day by dumping a load left from the previous collection day.

Figure 53 shows a vehicle which at the end of the day returns directly from the route to the motor pool.

FIGURE 49

ANY CITY, U.S.A.

DAILY COLLECTION ROUTE INFORMATION

ROUTE_____ DATE_____ DAY_____ CREW SIZE_____

VEHICLE NO._____ FUEL(GAL)_____ ENG.OIL(QT)_____

NO. HOMES SERVED_____	TIME	MILES	WEIGHT	DISCHARGE POINT *
LEAVE MOTOR POOL				
START COLLECTION				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE AT MOTOR POOL				

LUNCH - START			BREAKDOWN - PROBLEM (Circle Number)
- FINISH			1 Brakes, wheels, tires
BREAKDOWN - START			2 Cooling or exhaust sys 3 Electrical sys 4 Fuel sys 5 Packer 6 Power or steering sys 7 Other
- FINISH			
VEHICLE REPLACED			

* ENTER NUMBER
1=INCINERATOR
2=LANDFILL
3=TRANSFER STATION

REMARKS:

DATA VERIFIED BY:_____

Figure 50

DAILY COLLECTION ROUTE INFORMATION

ROUTE 01-21 DATE Apr 18 DAY Wed CREW SIZE 4

VEHICLE NO. 73240 FUEL(GAL) 20 ENG.OIL(QT) _____

NO. HOMES SERVED 492	TIME	MILES	WEIGHT	DISCHARGE POINT *
LEAVE MOTOR POOL	700	12187		
START COLLECTION	710	12190		
LEAVE ROUTE	915	12194		
AT DISCHARGE POINT			35280	2
ARRIVE BACK ON ROUTE	955	12205		
LEAVE ROUTE	1205	12209		
AT DISCHARGE POINT			34740	2
ARRIVE BACK ON ROUTE	110	12220		
LEAVE ROUTE	230	12222		
AT DISCHARGE POINT			29020	2
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE AT MOTOR POOL	315	12235		

LUNCH - START	1230	12217	BREAKDOWN - PROBLEM (Circle Number)
- FINISH	105	12217	1 Brakes, wheels, tires 2 Cooling or exhaust sys 3 Electrical sys 4 Fuel sys 5 Packer 6 Power or steering sys 7 Other
BREAKDOWN - START			
- FINISH			
VEHICLE REPLACED			

* ENTER NUMBER
1=INCINERATOR
2=LANDFILL
3=TRANSFER STATION

REMARKS:

DATA VERIFIED BY: Bill Jones

Figure 51

DAILY COLLECTION ROUTE INFORMATION

ROUTE 02-12 DATE Apr 24 DAY Tues CREW SIZE 4

VEHICLE NO. 72894 FUEL(GAL) 21 ENG.OIL(QT) 1

NO. HOMES SERVED 632	TIME	MILES	WEIGHT	DISCHARGE POINT *
LEAVE MOTOR POOL	645	38967		
START COLLECTION				
LEAVE ROUTE				
AT DISCHARGE POINT			30180	2
ARRIVE BACK ON ROUTE	725	38978		
LEAVE ROUTE	935	38982		
AT DISCHARGE POINT			32620	2
ARRIVE BACK ON ROUTE	1020	38994		
LEAVE ROUTE	110	38997		
AT DISCHARGE POINT			33280	2
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE AT MOTOR POOL	150	39009		

			BREAKDOWN - PROBLEM (Circle Number)
LUNCH - START	1120	38995	
- FINISH	1145	38995	1 Brakes, wheels, tires 2 Cooling or exhaust sys 3 Electrical sys 4 Fuel sys 5 Packer 6 Power or steering sys 7 Other
BREAKDOWN - START			
- FINISH			
VEHICLE REPLACED			

* ENTER NUMBER
1=INCINERATOR
2=LANDFILL
3=TRANSFER STATION

REMARKS:

DATA VERIFIED BY: John Smith

Figure 52

DAILY COLLECTION ROUTE INFORMATION

ROUTE 01-12 DATE Apr 27 DAY Fri CREW SIZE 4

VEHICLE NO. 70929 FUEL(GAL) 17 ENG.OIL(QT) _____

NO. HOMES SERVED 404	TIME	MILES	WEIGHT	DISCHARGE POINT *
LEAVE MOTOR POOL	700	0		
START COLLECTION	715	4		
LEAVE ROUTE	1020	9		
AT DISCHARGE POINT			33760	2
ARRIVE BACK ON ROUTE	1150	22		
LEAVE ROUTE	110	26		
AT DISCHARGE POINT			33220	2
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE AT MOTOR POOL	145	39		

			BREAKDOWN - PROBLEM (Circle Number)
LUNCH - START	1110		1 Brakes, wheels, tires
- FINISH	1140		2 Cooling or exhaust sys
BREAKDOWN - START			3 Electrical sys
- FINISH			4 Fuel sys
			5 Packer
			6 Power or steering sys
			7 Other
VEHICLE REPLACED			

* ENTER NUMBER
1=INCINERATOR
2=LANDFILL
3=TRANSFER STATION

REMARKS:

DATA VERIFIED BY: Bill Jones

Figure 53

DAILY COLLECTION ROUTE INFORMATION

ROUTE 01-21 DATE Apr 24 DAY Tues CREW SIZE 4

VEHICLE NO. 73240 FUEL(GAL) 13 ENG.OIL(QT) _____

NO. HOMES SERVED 409	TIME	MILES	WEIGHT	DISCHARGE POINT *
LEAVE MOTOR POOL	655	12340		
START COLLECTION	720	12345		
LEAVE ROUTE	1035	12350		
AT DISCHARGE POINT			39380	2
ARRIVE BACK ON ROUTE	1140	12363		
LEAVE ROUTE	135	12367		
AT DISCHARGE POINT			38840	2
ARRIVE BACK ON ROUTE	210	12370		
LEAVE ROUTE	235	12371		
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE BACK ON ROUTE				
LEAVE ROUTE				
AT DISCHARGE POINT				
ARRIVE AT MOTOR POOL	250	12376		

			BREAKDOWN - PROBLEM (Circle Number)
LUNCH - START	1055	12358	1 Brakes, wheels, tires
- FINISH	1130	12358	2 Cooling or exhaust sys
BREAKDOWN - START			3 Electrical sys
- FINISH			4 Fuel sys
			5 Packer
			6 Power or steering sys
VEHICLE REPLACED			7 Other

* ENTER NUMBER
1=INCINERATOR
2=LANDFILL
3=TRANSFER STATION

REMARKS:

DATA VERIFIED BY: Bill Jones

DATA PROCESSING ACTIVITY

Background Data. The COLMIS program requires the creation of three internal data files. These files contain constant background data relative to the solid waste collection district or city, the collection routes being monitored, and the solid waste collection vehicles available for day-to-day use.

The information required for the creation of these three constant data files is obtained by completing the information requested on the following data forms:

District Information	Figure 54
Route Information	Figure 55
Vehicle Information	Figure 56

The information required on these forms must be obtained from the management of the solid waste collection agency. The information needs to be as accurate as possible, and it needs to be updated whenever changes occur. A brief description of the data requested on each form follows:

District Information Form (See Figure 54)

District Number This number represents the first two digits of the route identification number - area and district.

Total Number of Routes The total number of collection routes to be monitored in the corresponding collection district. (Must match number of routes identified under this district number in Figure 55.)

Normal Work Day The number of hours per day considered to be the standard working day.

Driver Overtime Factor The appropriate overtime factor for the collection crew collectors.

Lunch Time The authorized lunch time in minutes.

Collection Frequency The frequency of collection based upon the number of times a typical resident will receive collection services in a given week's time.

In the case of a system where two different types of systems are servicing the same set of homes, various discrepancies will occur in the city averages. For example, if one system of garbage and trash collection, twice a week, is defined under the 10-00 series of route numbers and a one day dry trash collection is defined under the 20-00 series, all information summarized within each system will be accurate for that specific function. On city-wide figures, however, the two systems will be averaged instead of added together. For overall system time and cost summarization this is as it should be. But on a per home basis, it is incorrect. For instance, if garbage and trash collection costs 20¢ per home per week and dry trash pickup cost 10¢, the true cost per home per week is 30¢. The COLMIS reports would report 15¢, the result of averaging. This will be true of all per home and per person statistics.

Route Information Report (see Figure 55)

Route Number This number is the complete route identification number as discussed in Volume I, Chapter II.

Salary of Driver The salary of the collection crew driver in dollars. The cost of fringe benefits and overhead must be considered by adjusting the direct labor cost accordingly. Thus, if the direct labor cost is $5.00 per hour and fringe benefits and overhead are considered to be 30% of direct labor cost, an additional cost of $1.50 per hour must be added to reflect this situation, thereby resulting in a salary figure of $6.50 per hour.

Salary of Collector The salary of a single collection crew collector in dollars. Again, the cost of fringe benefits and overhead should be considered by adjusting the direct labor cost as discussed above.

Average People Per Home The average number of people per residential collection point. This number is generally available from census data and can be based upon people per collection stop or people per dwelling unit, depending upon the definition used for the number of homes served as recorded on the driver's Daily Collection Route Information form. See discussion in Volume I, Chapter II.

Number of Collection Days Per Week The total number of regularly scheduled days of residential collection for this collection route.

Collection Days Enter a one (1) for each day of the week in which this collection route services primarily residential collection areas. The sum of the individual days of the week collection indicated here must agree with the previous entry for the number of collection days per week.

When data is submitted for any day that a "1" is not entered, labor costs will be calculated at overtime rates.

Vehicle Information Form (see Figure 56)

Vehicle Number A five digit unique vehicle identification number. This number should be recorded somewhere on the vehicle so that the collection crew driver can readily record it as the vehicle used for collection on the Daily Collection Activity Report.

Vehicle Type Two letters to indicate the type of collection vehicle. Suggested codes are:

RL = rear loader
FL = front loader
SL = side loader
OT = open truck

Vehicle Size The appropriate size of the vehicle in cubic yards of capacity.

Fuel Cost The cost of fuel for this vehicle in dollars per gallon.

Oil Cost The cost of engine oil for this vehicle in dollars per quart.

Maintenance Cost Per Day The average maintenance cost for this vehicle per day of operation in dollars. This maintenance figure may be adjusted to include such things as insurance, cost of consumables if desired, or capital related overhead.

Depreciation Cost Per Day The average depreciation cost for this vehicle per day of operation in dollars. The following is a suggested formula for computing depreciation

cost per day:

$$\text{Depreciation Cost Per Day} = \frac{\text{(Cost of Vehicle - Salvage Value)}}{\text{(Average Number of Days Used Per Year X Useful Life)}}$$

Tare Weight Enter the tare weight of the vehicle in pounds if the weights obtained at the disposal facilities are gross weights. Enter zero (0) if the weights obtained at the disposal facilities are net weights.

Weekly Input Preparation. The Daily Collection Route Information forms are keypunched according to the format in Table 4. These cards are sorted in ascending sequence by:

Route Number	card columns	1-4	numeric	major field
Date	card columns	5-10	numeric	intermediate
Card Number	card columns	11	numeric	minor field

A date card, a header card, an option card, and an end-of-file card are prepared according to Table 5. The input deck is then assembled in the following order:

Header Card
Option Card
Date Card
Daily Data
End-of-file Card

preceded and followed by appropriate job control cards to execute the program and describe the files (see Volume II). A sample weekly deck is shown (Figure 57).

The option card (Table 5) provides many choices which help tailor COLMIS to a city's needs (see Figure 58). Some options represent permanent policy decisions, while others pertain only to individual program runs.

Options 1 and 2 are set to "yes" only for the first run of the program and to reset the files at the end of each year. They cause the program to create a file of zero records to use as a YTD file.

Option 3 has to be set to "yes" if any input data are to be read. Setting it to "no" will cause data to be ignored. Therefore, any time data are to be processed, the edit is required.

Options 4 through 7 control which reports are to be printed. Both 4 and 5 would not normally be requested in the same run. Use of these options eliminates needless generation of any report that management feels it does not need.

When option 7 is "yes", options 8 through 10 determine which organizational units are to be ranked in the comparison reports. These options are mutually exclusive. If more than one is designated "yes", the first one specified is assumed. If none are designated, 10 is assumed.

Option 11 gives the capability of printing the information of the year to date file before updating.

Option 12 gives the capability of printing the information of the year to date file after updating.

Options 13 and 14 make it possible through a "yes" designation to suppress updating of the year to date files. These would be used, for example, if the report was to be rerun solely for printed copies of the report and the file update was correct on the first run.

Options 15 and 16, through "yes" designations, make it possible to rerun a period of data. Normally, at the beginning of the program execution, the YTD files (data set 4) are copied to another disk area (data set 3). Data set 3 is then used as input YTD files and updated information is written into the data set 4 area, thus destroying what was there before. If you desire to rerun a period of data and update the files correctly (disregarding the incorrect data in data set 4) specifying yes in these options will bypass the copy of data set 4 to data set 3.

Option 17 must always be set to "yes" if COLMIS is to be used only on a monthly basis. If weekly reports are desired, then the COLMIS must always be run on a weekly basis and this option set to "no."

Monthly Input Preparation. The daily data from the weekly COLMIS runs are sorted together in the same sequence as in the weekly procedures. One data card for each week of data

used (up to five), a header card, an option card and an end-of-file card are needed (Table 5). The input deck is then assembled in the following order:

Header Card
Option Card
Date Cards
Daily Data
End-of-file Card

preceded and followed by job control cards to execute the program and describe the files (see Volume II). A sample monthly deck is shown in Figure 57.

Editing. The first step of the COLMIS program is to edit all the daily input. The criteria which the program is set up to use are itemized in Table 6 along with the error messages which will be printed in the edit report to indicate specific problems. A city may wish to revise the editing criteria, such as limits on miles per day or fuel consumption, to make them more useful in eliminating inadvertent errors. The route number, date, and appropriate message (Table 6) will be printed for every day of data expected by the program. If an error message is printed all the data for that route that day is rejected. If two sets of data appear for the same route on the same day, the second set is rejected with a sequence error indication.

The city should make determinations as to who should review the edit reports for purposes of correcting errors before another or final run is made. There should also be a policy regarding a maximum acceptable rejection rate.

The same edit is used for both weekly and monthly reports.

FIGURE 54

COLLECTION OPERATIONS

DISTRICT INFORMATION

City Any City, U.S.A. Date April 2, 1973

District Number	Total Number of Routes	Normal Work day (hours)	Driver Overtime Factor	Collector Overtime Factor	Lunch Time (Min)	Collection Frequency (per week)
01	4	8	1.5	0	30	1
02	4	8	1.5	0	30	1

FIGURE 55

COLLECTION OPERATIONS

ROUTE INFORMATION

City Any City, U.S.A. Date April 2, 1973

Route Number	Salary of Driver (Dollars)	Salary of Collector (Dollars)	Average People Per Home	Number of Collection days per week	Collection Days					
					Mon	Tues	Wed	Thur	Fri	Sat
01-11	5.70	5.45	3.06	5	1	1	1	1	1	
01-12	5.70	5.45	3.06	5	1	1	1	1	1	
01-21	5.70	5.45	2.88	5	1	1	1	1	1	
01-22	5.70	5.45	2.88	5	1	1	1	1	1	
02-11	5.70	5.45	2.69	5	1	1	1	1	1	
02-12	5.70	5.45	2.69	5	1	1	1	1	1	
02-21	5.70	5.45	3.12	5	1	1	1	1	1	
02-22	5.70	5.45	3.12	5	1	1	1	1	1	

FIGURE 56

COLLECTION OPERATION

VEHICLE INFORMATION

City Any City, U.S.A Date April 2, 1973

Veh Number	Veh Type	Veh Size (cu yds)	Fuel Cost (Dollars/ Gallon)	Oil Cost (Dollars/ Quart)	Maint Cost per day (Dollars)	Depreciation cost per day (Dollars)	Tare Weight (pounds)
70929	RL	20	.27	.32	12.75	15.45	20640
70930	RL	20	.27	.32	12.75	15.45	20400
70940	RL	20	.27	.32	12.75	15.45	21180
72887	RL	20	.27	.32	8.95	17.80	19820
72894	RL	20	.27	.32	8.95	17.80	20520
72902	RL	20	.27	.32	8.95	17.80	20360
73237	RL	25	.27	.32	6.27	19.64	23200
73240	RL	25	.27	.32	6.27	19.64	23640
73241	RL	25	.27	.32	6.27	19.64	23720
73250	RL	25	.27	.32	6.27	19.64	22860

TABLE 4

DAILY DATA INPUT CARD FORMAT

CARD 1

Card Columns	Field Name		Source	Size	Type	Comments
1 - 4	Route Number		DAILY COLLECTION ROUTE INFORMATION FORM	4	NUMERIC	
5 - 10	Date			6		Calender
11	Card Number			1		"1"
12	Day			1		*
13	Crew Size			1		
14 - 18	Vehicle Number			5		
19 - 20	Fuel			2		Gallons
21 - 22	Oil			2		Quarts
23 - 26	Homes Served			4		
27 - 30	Leave Motor Pool	- Time		4		
31 - 34		- Miles		4		
35 - 38	Return Motor Pool	- Time		4		
39 - 42		- Miles		4		
43 - 50	Start Lunch	- Time		4		
51 - 54	Finish Lunch	- Time		4		
55 - 58		- Miles		4		
59 - 62	Start Breakdown	- Time		4		
63 - 66		- Miles		4		
67 - 70	Finish Breakdown	- Time		4		

TABLE 4 (Cont'd)

DAILY DATA INPUT CARD FORMAT

CARD 1

Card Columns	Field Name	Source	Size	Type	Comments
71 - 74	- Miles	DAILY COLLECTION ROUTE INFORMATION FORM	4	NUMERIC	
75 - 79	Vehicle Replaced - Time				
	Code - Number of Cards		1		"2" if 2 cards "3" if 3 cards

*1 - Monday
2 - Tuesday
3 - Wednesday
4 - Thursday
5 - Friday
6 - Saturday

TABLE 4 (Cont'd)

DAILY DATA INPUT CARD FORMAT

CARD 2

Card Columns	Field Number	Source	Size	Type	Comments
1 - 4	Route Number	DAILY COLLECTION ROUTE INFORMATION FORM	4	NUMERIC	
5 - 10	Date		6		Calendar
11	Card Number		1		"2"
12 - 15	Start Collection - Time		4		
16 - 19	- Miles		4		
20 - 23	Leave Route - Time		4		
24 - 27	- Miles		4		
28 - 32	Weight - 1st Load		5		Pounds
33	Discharge Point		1		Enter Number
34 - 37	Arrive on Route - Time				
38 - 41	- Miles		4		
42 - 45	Leave Route - Time		4		
46 - 49	- Miles		4		
50 - 54	Weight - 2nd Load		5		Pounds
55	Discharge Point		1		Enter Number
56 - 59	Arrive on Route - Time		4		
60 - 63	- Miles		4		
64 - 67	Leave Route - Time		4		
68 - 71	- Miles		4		
72 - 76	Weight - 3rd Load		5		Pounds
77	Discharge Point		1		Enter Number

TABLE 4 (Cont'd)

DAILY DATA INPUT CARD FORMAT

CARD 3

Card Columns	Field Name	Source	Size	Type	Comments
1 - 4	Route Number	DAILY COLLECTION ROUTE INFORMATION FORM	4	NUMERIC	
5 - 10	Date		6		Calender
11	Card Number		1		"3"
12 - 15	Arrive on Route - Time		4		
16 - 19	- Miles		4		
20 - 23	Leave Route - Time		4		
24 - 27	- Miles		4		
28 - 32	Weight - 4th Load		5		Pounds
33	Discharge Point		1		Enter Number
34 - 37	Arrive on Route - Time		4		
38 - 41	- Miles		4		
42 - 45	Leave Route - Time		4		
46 - 49	- Miles		4		
50 - 54	Weight - 5th Load		5		Pounds
55	Discharge Point		1		Enter Number

TABLE 5

HEADER CARD FORMAT

Card Columns	Field Name	Type	Comments
1 - 72	City Name	Alphanumeric	Centered

OPTION CARD FORMAT

Card Columns	Option	Yes	No
1	Create weekly YTD file	"1"	"0"
2	Create monthly YTD file	"1"	"0"
3	Edit	"1"	"0"
4	Produce detail weekly report	"1"	"0"
5	Produce detail monthly report	"1"	"0"
6	Produce summary report	"1"	"0"
7	Produce management analysis report	"1"	"0"
8	Compare by route in analysis report	"1"	"0"
9	Compare by route supervisor in analysis report	"1"	"0"
10	Compare by organizational unit in analysis report	"1"	"0"
11	Print YTD file before update	"1"	"0"
12	Print YTD file after update	"1"	"0"
13	Do not update weekly YTD file	"1"	"0"
14	Do not update monthly YTD file	"1"	"0"
15	Use weekly back-up file	"1"	"0"
16	Use montly back-up file	"1"	"0"
17	Produce detailed monthly report without having produced weekly report	"1"	"0"

Note: Option 8, 9, and 10 are mutually exclusive; if more than one is specified, the first one specified on the card is assumed; if none are specified, 10 is assumed.

TABLE 5 (cont'd)

DATE CARD FORMAT

Card Columns	Field Name	Size	Type	Comments
2 - 7	Monday's Date	6	Numeric	
9 - 14	Tuesday's Date	6	Numeric	
16 - 21	Wednesday's Date	6	Numeric	
23 - 28	Thursday's Date	6	Numeric	
30 - 35	Friday's Date	6	Numeric	
37 - 42	Saturday's Date	6	Numeric	
80	Last Date Card Code	1	Numeric	"9" if only or last date card, else blank blank

END-OF-FILE CARD FORMAT

Card Columns	Field Name	Size	Type	Comments
1 - 4	End File	4	Numeric	"9999"

Figure 57

Sample Input Decks

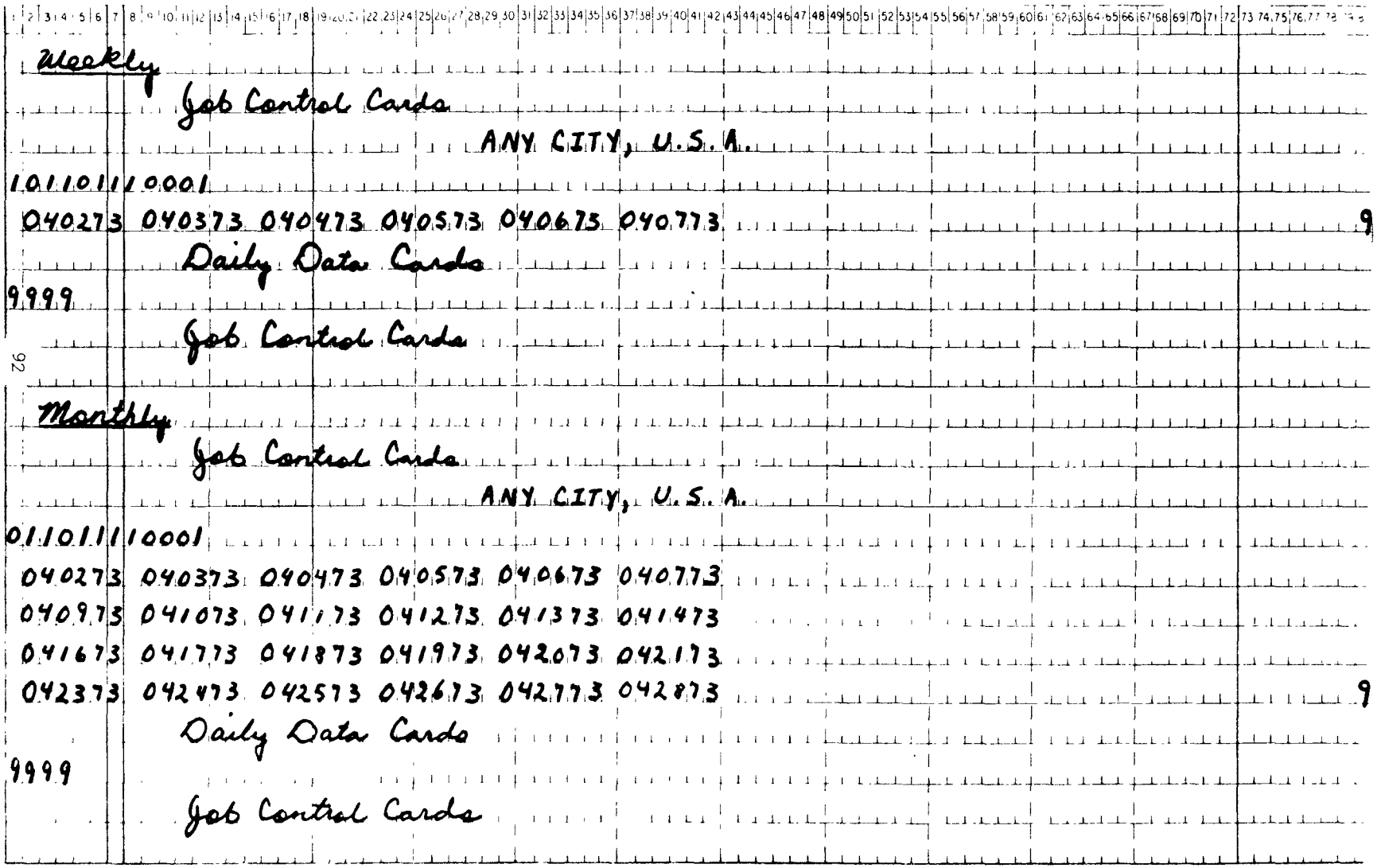


TABLE 6

Edit Criteria and Report Messages

Item	Messages	Edit Criteria	Reason for Message
Route Number	ROUTE	Four numeric digits. Must match a background data entry.	No matching background data entry. Blank
Date & Day	DAY	Date matches a date card entry. Day must have date entry on a date card. Day - 1 through 6. Date + day must agree.	Date and day do not agree. Blank.
Crew Size	CREW SIZE	Must be numeric and greater than zero.	Zero, negative, or blank.
Vehicle Number	VEHICLE	Up to five digits. Must match a background data entry.	No matching background data entry. Blank.
Fuel	FUEL	Greater than or equal to zero. Less than or equal to 50 gallons.	Negative or exceeds 50 gallons.
Oil	OIL	Greater than or equal to zero. Less than or equal to 20 quarts.	Negative or exceeds 20 quarts.
Home	HOME	Greater than zero.	Zero, negative or blank.

Table 6 (Cont'd)

Edit Criteria and Report Messages

Item	Messages	Edit Criteria	Reason for Message
Time	TIME	Sum of the time to route, collecting, and transporting not greater than 720 minutes. The total to route, collection, transport, maintenance or lunch time is not less than zero.	Total time exceeds 720 minutes. The total of any time segment is less than zero. Times recorded out of sequence - check for transposition of digits.
Miles	MILES	Sum of distance to route, collecting, and transporting not greater than 120 miles. Total to route, collection, transport, maintenance or lunch distance not less than zero.	Total mileage exceeds 120 miles. Total of any segment is less than zero. Odometer readings recorded out of sequence - check for transposition of digits.
Load	LOAD	Discharge Point code must be entered for first load. Any Discharge Point code must be 1, 2, or 3.	Blank or other than 1, 2, or 3.
Weight	WT	Net weight is not less than zero. Total net weight of all loads not greater than 75,000 pounds.	Less than zero or greater than 75,000 pounds - check for transposition of digits.
	SEQUENCE ERROR	Refer to sort procedure.	Cards out of sequence. Date outside range on date cards. Date already processed for this route on this day.

Table 6 (Cont'd)

Edit Criteria and Report Messages

Item	Message	Edit Criteria	Reason for Message
	VEHICLE REPLACED		Entry in vehicle replaced - time block.
	NO DATA SUBMITTED		Data expected but not submitted.
	NO REJECTION		Data valid

CHAPTER III

SUGGESTED OUTLINE OF ACTIVITIES FOR SUCCESSFUL INSTALLATION OF THE SYSTEM

Presentation of the System's Concepts

It is advantageous to begin the project by outlining, to all levels of management involved, the basic purpose, function, and operation of the system within their organization.

Collection of Background Data

The general information needed for the COLMIS computer program is collected from the appropriate sources. See Volume II.

Adaptation of the Program

The data processing staff familiarizes itself with the COLMIS program, codes and inserts the background data into the program, and tailors the program to the city organization and the computer available. See Volume II.

Printing of Daily Forms

Daily Collection Route Information forms should be procured in economical quantities, taking into consideration that one form is needed each day for each crew.

Briefing of Collection Crews

All drivers and route foremen or supervisors need to be instructed in the proper completion of the Daily Collection Route Information form. See Volume II.

Coordination of Data Flow

Procedures need to be determined for the flow of data from the collection staff to data processing, and for the transmittal of reports to the appropriate managers.

System Testing

A one or two-week system test is recommended. During this time most questions on input requirements will be resolved. Administrative procedures can be reviewed and modified as is appropriate.

Management Seminar

A management seminar should be conducted by top management for all supervisors and managers who will be using the reports. An exchange of ideas will lead all to a better understanding of how the reports can be interpreted and best used as an effective management tool to improve the collection system.

APPENDIX I

DEFINITION OF TERMS

For convenience the significant terms used with the MIS are defined below. These terms are also defined in the appropriate portion of the manual.

Collection Cost Information Report. That portion of the MIS outputs that provides cost related information.

Collection Information Report. That portion of the MIS outputs that provides collection related data.

Collection System Operation Summary. That portion of the MIS outputs that includes selected items from the Route Information Report, Collection Information Report, and Collection Cost Information Report for summary purposes.

Comparison Report. That portion of the MIS outputs that provides a ranking of organizational elements according to their performance in the variable selected. Comparison reports are provided for the Route Information Report, Collection Information Report and Collection Cost Information Report.

Crew Size. The total number of individuals including the driver operating with a collection vehicle.

Editing Report. That portion of the MIS outputs that provides information on why data are rejected by the computer program.

Management Analysis Report. A special report in which data summaries are provided for each element of the organization to facilitate a direct comparison of every organizational element with every like element.

COLMIS. Abbreviation for the Collection Management Information System.

Monthly Report. A complete MIS output prepared on a monthly basis. In the monthly report route information is provided on a day of the week basis.

Route. The total effort of a collection crew and its vehicle for a period of one week.

Route Information Report. That portion of the MIS outputs that provides route related information.

Route Numbering System. Any route numbering scheme that is adopted to distinguish one organizational element from all others in the organization.

Weekly Report. A complete MIS output prepared on a weekly basis. In the weekly report day of the week information is provided by route.

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