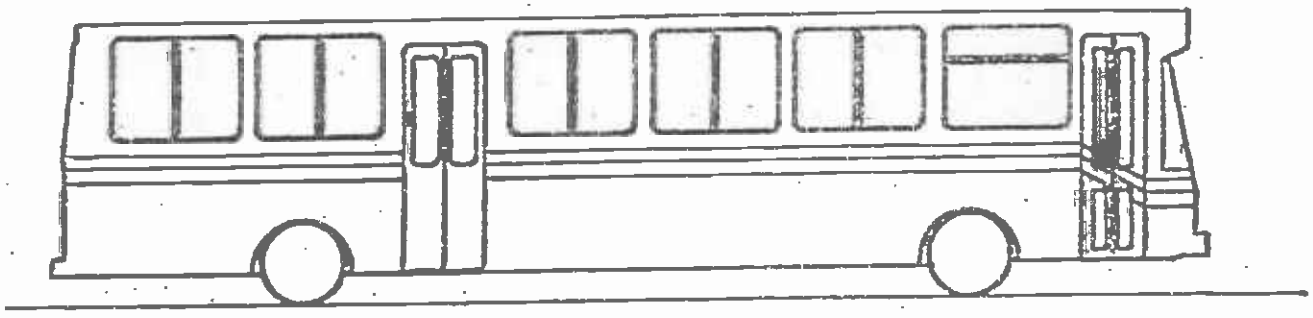
SCRTD GPC



BUS COST USER MANUAL

MAY, 1987

PREFACE

This manual describes the operation of a revised version of the earlier bus cost model program package, consisting of a FORTRAN program on the mainframe computer and a LOTUS 123 program on an MS-DOS compatible microcomputer. The package is designed to be used for calculating operating costs for bus operations associated with increases or decreases in service provided. The model generates these estimates from projections of annual bus operating statistics based upon the quantity of service provided by the whole system. The level-of-service measures that are used are:

1. Annual vehicle miles,
2. Annual vehicle hours,
3. Average weekday p.m. peak vehicles, and
4. Annual passenger boardings.

A more detailed description of the methodology used for computing the costs is provided in chapter 2 of PART II.

Major revisions in this version of the package over the previous one are:

1) The FORTRAN program now does precise computations of the number of days per year for each day of the week for a given year and set holidays. Only those holidays on which Sunday bus service is provided have to be considered. These days would be counted as Sundays.

2) The program also computes the specific number of days of operation per year for each line individually. That is, each line has its own number of weekdays, Saturdays, and Sundays that are used in computing annual totals.

3) The splitting or apportioning of passenger boardings and revenue for lines operating from more than one division has been incorporated in the FORTRAN program.

4) At the end of the FORTRAN program, a report is provided consisting of summaries of errors detected in input data files during execution and daily and annual totals of the level-of-service measures for each line and for the entire system.

5) Entry of annualization formulae into the LOTUS program database has been automated in order to make the program more user-friendly.

The description of the operation of this package is divided into two parts: PART I, which describes the mainframe FORTRAN program, and PART II, which describes the LOTUS program.

C O N T E N T S

PART I: THE FORTRAN PROGRAM

1. INTRODUCTION

PART I of the user's guide describes the operation of the FORTRAN program, BUSES, which reads in daily bus schedules, passenger boardings, and revenue and computes total daily and annual revenue bus miles, bus hours, passenger boardings, and cash-box revenue for each bus line and division. These output data are later downloaded from the IBM mainframe computer onto an IBM-PC and are used as input to the LOTUS bus-cost program for computation of bus operating costs. This part of the manual is divided into five sections which cover descriptions of input files, input parameters, output reports and files, summary of the input/output files and parameters, and how to download the output file onto a microcomputer.

This program can be run by executing the CLIST program MRP.DRIVER.CLIST(BUSES).

2. INPUT FILES

This program requires two sets of files: bus schedule files, and passenger revenue and boardings files. Bus schedule files are used for computation of daily revenue bus miles, bus hours, and p.m. peak buses (for weekday operations) for each line and division. The program also uses these files to count the number of days each line operates per week and converts them into corresponding numbers of days per year, which are then used to convert daily totals of level-of-service measures into annual totals. Separate computations are done for weekday, Saturday, and Sunday (including public holiday) bus operations.

The data obtained are then merged with data from passenger boardings and revenue files to produce a single set of output data with daily and annual totals of bus miles, bus hours, passenger boardings, and revenue for each line and division.

2.1 BUS SCHEDULE FILES

These are "424 SDS" files maintained on the IBM mainframe computer by the RTD scheduling department and they are built from schedules of all bus runs for each line and division for weekdays, Saturdays, and Sundays. The names of the files are in the following form:

SCP.SMGDAS.TEMP.SDSX0222 (weekday)
SCP.SMGDAS.TEMP.S2SA0222 (Saturday)
SCP.SMGDAS.TEMP.S2SU0222 (Sunday)

The last five characters of the filename give the type of day, (X=weekday, A=Saturday, U=Sunday) and the month and date that the data were created. In this example the database was created on February 22. The year is not given. The scheduling department creates new files every few months to reflect changes in the operating characteristics of the system. The user has to check with the department for the date of the latest data or any data desired. These "424" files cannot usually be accessed for processing, since they are protected files. Therefore, permission needs to be obtained from the scheduling department before attempting to use the files.

The format of the "424" files is given in the following table.

FORMAT FOR 424 FILES

Column	Type	Description
1	I4	Line number
5	I3	Direction of bus run
8	I3	Bus run number
11	I3	Pullout division number
14	I5	Pullout time (minutes after midnight)
19	F5.1	Pullout miles
24	I5	Near terminal time
29	F5.1	Trip miles
34	I5	Far terminal time
39	F5.1	Deadhead miles
44	I5	Pullin time (minutes after midnight)
49	I3	Pullin division
52	F5.1	Pullin miles
57	1x	blank
58	7I1	Days of week applicable
65	I2	School day operation
67	I2	Race day operation
69	I2	Bowl day operation
71	I6	Trip number
77	I4	Foreign line number

The records in these files have to be sorted (this is done in the JCL) by line number, bus run number, and near-terminal time before being submitted for processing by the FORTRAN program.

2.2 PASSENGER BOARDINGS AND REVENUE FILES

The other set of input files consists of passenger boardings and revenue data by bus line and type of day (i.e., weekday, Saturday, or Sunday). This data can be found in the "Line Performance Trend Reports" or on the mainframe under the following file names:

MRPCCW.BOARD.REVENUE DAY (Weekday)
MRPCCW.BOARD.REVENUE.SAT (Saturday)
MRPCCW.BOARD.REVENUE.SUN (Sunday)

The format for data in these files is given below:

Column Number	Variable Type	Description
2	I3	Line Number
5	A2	Day of Week (e.g., MO for Monday)
8	I6	Date of Survey: year, month, date
16	I7	Passenger Boardings
24	I7	Cashbox Revenue

These three files are maintained by the Information Systems Section of the Planning Department and are continually being updated as new bus survey results are entered which replace the older data, new bus lines are introduced, or existing bus lines are removed from service. Note that the data in these files are not split by divisions. Therefore, in order to be able to merge these files and the bus-schedule files, passenger boardings and revenue for lines operating from more than one division have to be apportioned to the various divisions of the line in proportion to the bus miles generated by each division for the given line. This process is incorporated in the program.

3. INPUT PARAMETERS

The user has to input a number of parameters or use their default values in order to enable the program to compute the number of days per year for each day of the week in a given year. All public holidays are counted as Sundays. The user can also input the title of the program run and the maximum bus-line and division numbers. The following is a description of the input parameters.

TITLE: The title of the program run. The user can input any combination of not more than 50 alphanumeric characters, including any spaces between words or characters. The default TITLE is 'BUS-COST PROGRAM'.

LMAX: The maximum bus-line number. This should be a number higher than the highest bus-line number that appears in the bus timetables. All line numbers higher than or equal to LMAX will have their data combined under line LMAX. The default LMAX is 700.

IDMAX: The maximum division number. The default IDMAX is 25.

YEAR: The year for which operating cost calculations are desired, e.g., 1987.

NYDAY: The first three characters of the first day of the year, i.e., New Year's Day. For example, New Year's Day for 1987 was on Thursday, and therefore if Year=1987, then NYDAY=THU. This parameter is used in computation of the number of days per year for each day of the week, e.g., 1987 has 52 Mondays, 52 Tuesdays, etc.

HD(I): The Ist date-specific holiday. A date-specific holiday is one that always falls on a given date, for example:

```
HD(1) = 1.01     (Jan. 1st, New Year's Day)
HD(2) = 7.04     (July 4th, Independence Day)
```

This array of holiday dates can be input as a string of numbers separated by commas. For example, the default set of date-specific holidays are input in the following form:

```
HD = 1.01, 7.04, 12.25
```

The program can accept up to 20 dates and they do not have to be input in any logical order. For example, one could input the above dates as:

```
HD = 7.04, 1.01, 12.25
```

MON: The number of holidays that always fall on Mondays. For example, Memorial and Labor Days are the only holidays that are always celebrated on Mondays, therefore, MON=2. Thanksgiving Day is the only holiday which is always on Thursday; hence,

THU=1.

These are known as day-specific holidays, and the user can input the number of such holidays in a year for each day of the week, using the first three characters of the day as the variable name, i.e., MON, TUE, WED, THU, FRI, SAT. The default is MON=2, THU=1, and the rest are all zero.

4. OUTPUT FILES AND REPORTS

4.1 OUTPUT REPORT

The report consists of five main parts:

1) Summary of input parameters,
2) A list of errors detected in bus-schedule data records,
3) Summary of daily and annual totals of bus miles, bus hours, passenger boardings, and revenue for each line from each division. For weekday summaries, there is also the number of p.m. peak buses required.
4) Summary of the output data and system totals.
5) Summary of errors detected and standard corrective measures taken.

4.1.1 Summary of Input Parameters

The input data summary consists of:

1) The maximum bus line number,
2) The maximum division number,
3) The calendar year specified,
4) New Year's Day,
5) Date-specific holidays,
6) Day-specific holidays, and
7) The computed number of days per year for each day of the week.

A typical printout of this part of the report is given in Figure I-4.1. Together with the input parameters, the number of days per year for each day of the week, as computed by the program, is also printed.

INPUT DATA SUMMARY :

HIGHEST BUS LINE NO. = 700
HIGHEST DIVISION NO. = 25

CALENDER YEAR = 1986 NEW YEAR DAY = WED

DATE-SPECIFIC HOLIDAYS : MONTH DATE DAY

1	1	WED
7	4	FRI
12	25	THU

DAY-SPECIFIC HOLIDAYS :

MONDAYS	= 2
TUESDAYS	= 0
WEDNESDAYS	= 0
THURSDAYS	= 1
FRIDAYS	= 0

NO. OF DAYS PER YEAR FOR EACH DAY OF THE WEEK :

SUNDAYS & HOLIDAYS	= 58	
MONDAYS	= 50	(EXCLUDING HOLIDAYS)
TUESDAYS	= 52	"
WEDNESDAYS	= 52	"
THURSDAYS	= 50	"
FRIDAYS	= 51	"
SATURDAYS	= 52	"
TOTAL	= 365 DAYS	

FIGURE I-4.1
SUMMARY OF INPUT PARAMETERS

4.1.2 List of Errors Detected

This is a list of errors detected in the schedule data records during execution which are output in the order in which they are encountered. Standard corrective action taken, if any, is specified and the record(s) with the error is printed immediately below the error statement.

Figure I-4.2 is a typical output of a list of error messages.

```
  WEEKDAY DATA ERRORS : PAGE  3

ERROR 1 : DIFFERENT NO. OF DAYS PER WEEK FOR BUS LINE 169  DIVISION 15
 DAYS SET TO  5 : EXECUTION CONTINUING
169     4 15    0  0.0  700 26.6  777  0.0    0  0  0.0 0111100              0

ERROR 1 : DIFFERENT NO. OF DAYS PER WEEK FOR BUS LINE 169  DIVISION 15
 DAYS SET TO  5 : EXECUTION CONTINUING
169     4 15    0  0.0  803 16.2  880  0.0    0  0  0.0 0111100              0

ERROR 4 : DEADHEAD TIME TO NEXT TRIP COMPUTED NEGATIVE
 STANDARD CORRECTIVE ACTION TAKEN : EXECUTION CONTINUING
169     4 15    0  0.0  801 26.6  881  0.0    0  0  0.0                      0
169     4 15    0  0.0  803 16.2  880  0.0    0  0  0.0                      0

ERROR 1 : DIFFERENT NO. OF DAYS PER WEEK FOR BUS LINE 436  DIVISION  6
 DAYS SET TO  5 : EXECUTION CONTINUING
436     4  6  838 14.2  870 12.6  924  0.0    0  0  0.0 0111100             33

ERROR 1 : DIFFERENT NO. OF DAYS PER WEEK FOR BUS LINE 436  DIVISION  6
 DAYS SET TO  5 : EXECUTION CONTINUING
436     4  6    0  0.0  937 16.4 1002  0.8    0  0  0.0 0111100             33

ERROR 6 : DIFFERENT DIVISION NO. FOR SAME BUS RUN
 DIVISION NO. SET TO  12
456    10 10  982  3.1  992 26.6 1066  0.0 1070 10  1.3 0111110              0

ERROR 6 : DIFFERENT DIVISION NO. FOR SAME BUS RUN
 DIVISION NO. SET TO  16
480    58  9    0  0.0  995 25.0 1054  0.0    0  0  0.0 0111110              0

ERROR 6 : DIFFERENT DIVISION NO. FOR SAME BUS RUN
 DIVISION NO. SET TO  16
480    58  9    0  0.0 1067 37.2 1152  0.0 1155  9  0.9 0111110              0

ERROR 6 : DIFFERENT DIVISION NO. FOR SAME BUS RUN
 DIVISION NO. SET TO  16
480    60  9    0  0.0  488 25.0  547  0.0    0  0  0.0 0111110              0
```

FIGURE I-4.2
LIST OF ERROR MESSAGES

4.1.3 Daily and Annual Totals

This is an output of:

1) Daily and annual totals of bus hours, bus miles, passenger boardings, and revenue by bus-line and division.
2) The total number of days each line operates per year.
3) For weekday data, the number of buses operating during the p.m. peak period (3 p.m. - 6 p.m.). Related to this is the number of "interline" peak buses, which is the number of peak buses operating on a line but having been "borrowed" from another line. The net number of peak buses is then given by p.m. PEAK BUSES minus the INTERLINE BUSES. It is this number of net peak buses that is later used in cost computations.

The number of peak buses for Saturday and Sunday bus operations is not computed, and hence blanks appear in the peak-buses columns for these days.

Figure I-4.3 shows part of a typical output for daily and annual totals. For those lines that are in the passenger boardings and revenue files but not appear in the schedule files, zeros will appear under all items except the daily boardings and revenue. On the other hand, if a line appears in the schedule files but not in the boardings and revenue files, zeros will appear in the daily and annual figures for boardings and revenue. These two cases occur as a result of inconsistency between the schedule files and the boardings/revenue files.

		ANNUAL TOTALS						DAILY TOTALS				
LINE	DIV	BUS HOURS	BUS MILES	TOTAL PASS	TOTAL REV	PEAK BUSES	INTER-LINE	BUS HOURS	BUS MILES	TOTAL PASS	TOTAL REV	DAYS/ YEAR
1	7	89789.7	863156.2	6061350	2269500	26	1	352.1	3384.9	23770	8900	255
2	7	99932.3	1157134.0	6024375	2204730	27	1	391.9	4537.8	23625	8646	255
4	6	58490.6	609266.0	3454485	1325235	19		229.4	2389.3	13547	5197	255
4	7	105518.9	1194055.0	6769995	2597430	25	2	413.8	4682.6	26549	10186	255
10	7	71848.3	704495.4	4884780	1822485	25	2	281.8	2762.7	19156	7147	255
14	1	43709.1	518105.2	4198065	1698300	18	3	171.4	2031.8	16463	6660	255
14	7	55398.7	599680.1	4859025	1965540	19	2	217.2	2351.7	19055	7708	255
16	1	69563.9	653029.9	6254895	2186880	24	1	272.8	2560.9	24529	8576	255
18	1	83359.4	987722.0	7995780	3167865	29		326.9	3873.4	31356	12423	255
20	6	65080.2	707594.9	4401555	1683255	22		255.2	2774.9	17261	6601	255
20	7	72150.1	807132.3	5020695	1919895	22		282.9	3165.2	19689	7529	255
20	10	111866.3	1206936.0	7507710	2871045	35	1	438.7	4733.1	29442	11259	255
26	1	45288.0	430575.8	3384870	1376235	14		177.6	1688.5	13274	5397	255
28	7	46605.5	487469.7	2808825	1037340	13		182.8	1911.6	11015	4068	255
28	10	79549.3	942526.1	5430990	2005830	30		312.0	3696.2	21298	7866	255
30	1	128919.4	1395017.0	10678125	3829335	45	4	505.6	5470.7	41875	15017	255
33	6	36938.9	486051.1	2372010	979710	17	9	144.9	1906.1	9302	3842	255
33	10	69982.6	901622.4	4400280	1817385	18		274.4	3535.8	17256	7127	255
38	10	47472.5	508032.1	2631345	1003170	13		186.2	1992.3	10319	3934	255
40	5	84041.6	975301.8	4736370	1973955	29		329.6	3824.7	18574	7741	255
40	18	71293.7	810510.1	3936180	1640415	22		279.6	3178.5	15436	6433	255
45	10	105287.3	1202182.0	7674735	2888640	31		412.9	4714.4	30097	11328	255
48	5	30693.5	321667.6	1734255	725730	12		120.4	1261.4	6801	2846	255
51	18	83958.7	1066001.0	6884490	2785110	28		329.2	4180.4	26998	10922	255
53	18	60275.6	727253.7	4284510	1713600	19		236.4	2852.0	16802	6720	255
55	10	42202.5	562398.6	2410260	1075845	12	1	165.5	2205.5	9452	4219	255
55	18	28245.5	347230.6	1488180	664275	9		110.8	1361.7	5836	2605	255
56	10	13512.9	175108.0	648465	294780	5		53.0	686.7	2543	1156	255
56	18	24384.4	325889.5	1206660	548505	8		95.6	1278.0	4732	2151	255
60	10	81393.8	1018539.4	4546905	1900260	26		319.2	3994.3	17831	7452	255
60	12	75628.7	975151.8	4353105	1819170	25		296.6	3824.1	17071	7134	255
65	1	26898.2	336685.7	1691160	690540	8		105.5	1320.3	6632	2708	255
66	1	58218.6	713216.6	5490150	2170050	22		228.3	2796.9	21530	8510	255
68	10	79205.1	889163.9	5710470	2187135	25		310.6	3486.9	22394	8577	255
70	9	86551.2	1050207.0	5149215	2060910	30	2	339.4	4118.5	20193	8082	255
76	9	57100.9	736588.9	3158430	1174785	18		223.9	2888.6	12386	4607	255
78	9	71718.7	1062922.0	3476415	1444065	28		281.2	4168.3	13633	5663	255
81	3	41907.1	545313.4	3104370	1220685	14		164.3	2138.5	12174	4787	255
81	18	36409.7	471287.1	2683110	1054935	13		142.8	1848.2	10522	4137	255
83	3	51667.2	599960.9	3380280	1286220	19		202.6	2352.8	13256	5044	255
84	3	39059.6	436493.5	2278680	858585	17	6	153.2	1711.7	8936	3367	255
90	15	38167.1	627565.6	1630980	753325	17	1	149.7	2461.0	6396	2955	255
92	15	63231.5	921945.7	3181890	1339260	22		248.0	3615.5	12478	5252	255
94	15	69323.8	1132200.0	3554190	1703400	22		271.9	4440.0	13938	6680	255
96	15	44750.4	720192.4	1794690	786420	17		175.5	2824.3	7038	3084	255
97	15	14171.6	202392.4	466650	173145	5	1	55.6	793.7	1830	679	255
102	3	15234.1	190012.1	692325	281775	5	1	59.7	745.1	2715	1105	255
104	3	13593.6	238564.7	299115	151980	4		53.3	935.5	1173	596	255

FIGURE I-4.3 SUMMARY OF DAILY AND ANNUAL TOTALS

4.1.4 Output Summary

This is an output consisting of:

1) The number of lines and divisions processed,
2) A list of the division numbers,
3) A list of lines with missing bus schedule data, i.e., those lines appearing in the passenger boardings and revenue files but not appearing in the bus schedule files.
4) A list of lines with missing passenger boardings and revenue data, i.e., those lines appearing in the bus-schedule files but not in the passenger boardings and revenue files.
5) Gross and net number of p.m. peak buses required for the whole system.
6) The total system daily and annual bus-miles, bus-hours, passenger boardings and revenue

Figure I-4.4 shows a typical printout of the output summary data.

```
  WEEKDAY SUMMARIES : PAGE  5

OUTPUT SUMMARY DATA :

 NO. OF LINES READ = 162
 NO. OF DIVISIONS  =  13. THE DIVISIONS ARE :
    1   3   5   6   7   8   9  10  12  13  15  16  18

 THE FOLLOWING LINES HAVE NO PASSENGER/REVENUE DATA :
  183  442  700

 GROSS P.M. PEAK BUSES = 2106
 INTER-LINE SAVINGS    =  120
 NET P.M. PEAK BUSES   = 1986

 TOTAL DAILY BUS-HOURS  =   24954
 TOTAL DAILY BUS-MILES  =  344846
 TOTAL DAILY BOARDINGS  = 1387386
 TOTAL DAILY REVENUE    =  603063  (CASH-BOX REVENUE)
```

FIGURE I-4.4
OUTPUT SUMMARY DATA

```
  SATURDAY SUMMARIES : PAGE  4

 OUTPUT SUMMARY DATA :

  NO. OF LINES READ = 118
  NO. OF DIVISIONS  =  13. THE DIVISIONS ARE :
     1   3   5   6   7   8   9  10  12  13  15  16  18

  THE FOLLOWING LINES HAVE NO BUS SCHEDULE DATA :
   119  169  175  211

  THE FOLLOWING LINES HAVE NO PASSENGER/REVENUE DATA :
   161  183  270  439

 TOTAL DAILY BUS-HOURS  =   15959
 TOTAL DAILY BUS-MILES  =  210879
 TOTAL DAILY BOARDINGS  =  844750
 TOTAL DAILY REVENUE    =  328367  (CASH-BOX REVENUE)
```

```
  SUNDAY SUMMARIES : PAGE  4

 OUTPUT SUMMARY DATA :

  NO. OF LINES READ = 115
  NO. OF DIVISIONS  =  13. THE DIVISIONS ARE :
     1   3   5   6   7   8   9  10  12  13  15  16  18

  THE FOLLOWING LINES HAVE NO BUS SCHEDULE DATA :
   154  175  209

  THE FOLLOWING LINES HAVE NO PASSENGER/REVENUE DATA :
   161  183  270  439

 TOTAL DAILY BUS-HOURS  =   12887
 TOTAL DAILY BUS-MILES  =  172329
 TOTAL DAILY BOARDINGS  =  587752
 TOTAL DAILY REVENUE    =  243912  (CASH-BOX REVENUE)

 TOTAL ANNUAL BUS-HOURS =   7940566
 TOTAL ANNUAL BUS-MILES = 108894688
 TOTAL ANNUAL BOARDINGS = 431477988
 TOTAL ANNUAL REVENUE   = 184886433  (CASH-BOX REVENUE)
```

FIGURE I-4.4 (CONT.)
OUTPUT SUMMARY DATA

4.1.5 Error Messages

This provides a summary of the number and types of errors encountered during execution and a description of the standard corrective actions taken. Note that these are only those errors associated with bus schedule data. Below is a complete list of all error messages.

ERROR 1 :

DIFFERENT NO. OF DAYS PER WEEK FOR THE SAME LINE
STANDARD CORRECTIVE ACTION TAKEN : SET THE NO. OF DAYS EQUAL TO THE MAXIMUM OBSERVED FOR THE LINE-DIVISION COMBINATION

ERROR 2 :

CONSECUTIVE RECORDS NOT IN LOGICAL SEQUENCE
NO CORRECTIVE ACTION TAKEN : COMPUTE BUS-MILES AND BUS-HOURS IN THE ORDER OF THE RECORDS AND CONTINUE EXECUTION

ERROR 3 :

TRIP TIME COMPUTED ZERO OR NEGATIVE
STANDARD CORRECTIVE ACTION TAKEN : SET TRIP TIME EQUAL TO ZERO AND CONTINUE EXECUTION

ERROR 4 :

DEADHEAD TIME TO NEXT TRIP COMPUTED NEGATIVE
STANDARD CORRECTIVE ACTION TAKEN : HALF THE COMPUTED DEADHEAD TIME IS SUBTRACTED FROM EACH OF THE TWO CONSECUTIVE BUS TRIP TIMES

ERROR 5 :

DIVISION NO. HIGHER THAN MAXIMUM SUPPLIED
STANDARD CORRECTIVE ACTION TAKEN : DIVISION NO. SET TO IDMAX

ERROR 6 :

DIFFERENT NO. OF DIVISION FOR SAME BUS RUN
STANDARD CORRECTIVE ACTION TAKEN : DIVISION NO. SET TO THE PULL-IN DIVISION NO. FOR THE BUS RUN

ERROR 7 :
DIVISION NO. EQUAL TO ZERO
STANDARD CORRECTIVE ACTION TAKEN : DIVISION NO. SET TO THE IMMEDIATE PREVIOUS DIVISION NO.

FIGURE I-4.5
A SUMMARY OF ALL ERROR MESSAGES

4.2 THE OUTPUT FILE

The default name for the output file is MRP.BUSCOST.DATA, but the user can specify any other desired name. These output data consist only of the daily totals for bus miles and bus hours of operation, passenger boardings, and revenue for each bus line from each division. The data are divided into three segments, one each for weekday, Saturday, and Sunday (and public holiday) bus operation.

Column No.	Type of Variable	Description
5	I5	Line no.
10	I5	Division no.
15	F9.1	Daily Vehicle-hours
24	F9.1	Daily Vehicle-miles
33	I5	Net P.M. Peak Buses
38	I9	Daily Pass. Boardings
47	I9	Daily Cashbox Revenue
56	I5	No. of Days/year

Figure I-4.6 shows a portion of a typical output data file.

1	7	352.1	3384.9	25	23770	8900	255
2	7	391.9	4537.8	26	23625	8646	255
4	6	229.4	2389.3	19	13547	5197	255
4	7	413.8	4682.6	23	26549	10186	255
10	7	281.8	2762.7	23	19156	7147	255
14	1	171.4	2031.8	15	16463	6660	255
14	7	217.2	2351.7	17	19055	7708	255
16	1	272.8	2560.9	23	24529	8576	255
18	1	326.9	3873.4	29	31356	12423	255
20	6	255.2	2774.9	22	17261	6601	255
20	7	282.9	3165.2	22	19689	7529	255
20	10	438.7	4733.1	34	29442	11259	255
26	1	177.6	1688.5	14	13274	5397	255
28	7	182.8	1911.6	13	11015	4068	255
28	10	312.0	3696.2	30	21298	7866	255
30	1	505.6	5470.7	41	41875	15017	255
33	6	144.9	1906.1	8	9302	3842	255
33	10	274.4	3535.8	18	17256	7127	255
38	10	186.2	1992.3	13	10319	3934	255

FIGURE I-4.6
PART OF OUTPUT FILE PRINTOUT

5. SUMMARY OF INPUT/OUTPUT FILES AND PARAMETERS

INPUT/OUTPUT FILE TABLE

FILE SPECIFICATION	DESCRIPTION
FT01F001	SORTED BUS-SCHEDULE FILE, WEEKDAYS
FT02F001	SORTED BUS-SCHEDULE FILE, SATURDAYS
FT03F001	SORTED BUS-SCHEDULE FILE, SUNDAYS
FT08F001	PASS. BOARDINGS AND REVENUE FILE, WEEKDAYS
FT09F001	PASS. BOARDINGS AND REVENUE FILE, SATURDAYS
FT10F001	PASS. BOARDINGS AND REVENUE FILE, SUNDAYS
FT11F001	OUTPUT FILE

INPUT PARAMETERS

NAME	TYPE	DEFAULT	MAX.	DESCRIPTION
TITLE	A50	BUS-COST PROGRAM	-	TITLE OF THE PROGRAM RUN
LMAX	I4	700	1000	MAXIMUM LINE NUMBER
IDMAX	I2	25	50	MAXIMUM DIVISION NUMBER
YEAR	I4	-	2999	YEAR OF OPERATION
NYDAY	A3		-	FIRST THREE CHARACTERS OF NEWYEAR'S DAY
HD(I)	20F4.2	1.01,7.04,12.25	-	ARRAY OF DATE-SPECIFIC HOLIDAYS
MON	I2	2	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON MONDAYS
TUE	I2	0	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON TUESDAYS

NAME	TYPE	DEFAULT	MAX.	DESCRIPTION
WED	I2	0	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON WEDNESDAYS
THU	I2	1	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON THURSDAYS
FRI	I2	0	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON FRIDAYS
SAT	I2	0	-	NO. OF HOLIDAYS ALWAYS OBSERVED ON SATURDAYS

6. DOWNLOADING THE DATABASE

Up to this point all processing has been done in the mainframe environment. Now the output file MRP.BUSCOST.DATA (or the name that the user specified) has to be downloaded (i.e. transferred) into the microcomputer environment by copying the file on to a floppy disk for use on an microcomputer. The naming of the file is flexible but needs to reflect the type of data being transfered and must be named with a PRN extension so that it can easily be transported into the LOTUS 123 environment. For example one could name the file BUSCOST.PRN. The actual procedure or method of performing the file transfer will depend on the machine and software to be used.

How to incorporate the new database into the LOTUS bus-cost program is described in Chapter 4 of Part II.

PART II: THE LOTUS PROGRAM

1. GETTING STARTED

Preparing Your Software

Step 1: Check the contents of your Bus Cost System Disk.

To check the contents of your Bus Cost system disk, insert the Bus Cost System Disk into disk drive A of your computer. (On some computers, it may be the upper of two half-height drives, or, on the NECs, the front of the two.) Next, display the contents of the directory. To do this, be sure you have the A> prompt on the screen; then type DIR and press the return key. (To get the A> prompt, just type A: and press return.) The user should make sure his/her Bus Cost system disk contains the following files:

Auto123	This is the main menu.
Buscost5	The spreadsheet program that performs the cost calculations.
Primary	The file handling program.
Optmenu	A small file to link modules.
Permdata	The original database which you cannot change.
Tempdata	A database that you can store changes on, such as additions/deletions.

Step 2: Copying your Bus Cost System Disk.

Your Bus Cost system disk has a write-protect tab. Do not remove it and keep this disk as your source copy. Should you damage your copy you can always recreate it with this source disk.

First, format a new disk. To do this, place the unformatted, new disk in drive B and type:

FORMAT B:

Then press return. After formatting is complete, place the Bus Cost system disk in drive A and type :

COPY A:*.* B:

From now on, use the copied version of Bus Cost for all your calculations. Take the write-protected Bus Cost system disk and store it in a safe place. Do not place a write-protect tab on your new Bus Cost system disk, because the program needs to write files onto this disk.

Step 3: Running the Program

These instructions assume that you are running the model on a computer with two floppy disk drives.

Insert your LOTUS system disk (version 2) in disk drive A and the SQZ system disk in drive B (SQZ compacts LOTUS files and permits the storage of the Bus Cost files on one disk). Enter the following

command at the A> prompt:

B:SQZ 123

When SQZ starts, you see the startup message on the screen telling you SQZ is loaded into memory. When it is loaded, press any key, and SQZ will load LOTUS. When LOTUS is loaded, a blank spreadsheet will appear. Enter the following key strokes:

/FR

Then press return. This will load the AUTO123 file which contains the main menu. The screen should appear as in Figure II-1.1. Press the return key to move to the next screen which contains instructions on what data you may need. When you have finished reading this information, press the return key again and the main menu will appear. This is the menu that allows you to use the Bus Cost model. Chapters 3 through 8 explain how to use this menu to cost bus lines or operating divisions and forecast costs by changing the lines or divisions in various ways. Chapter 2 briefly presents the methodology used for estimation of these costs.

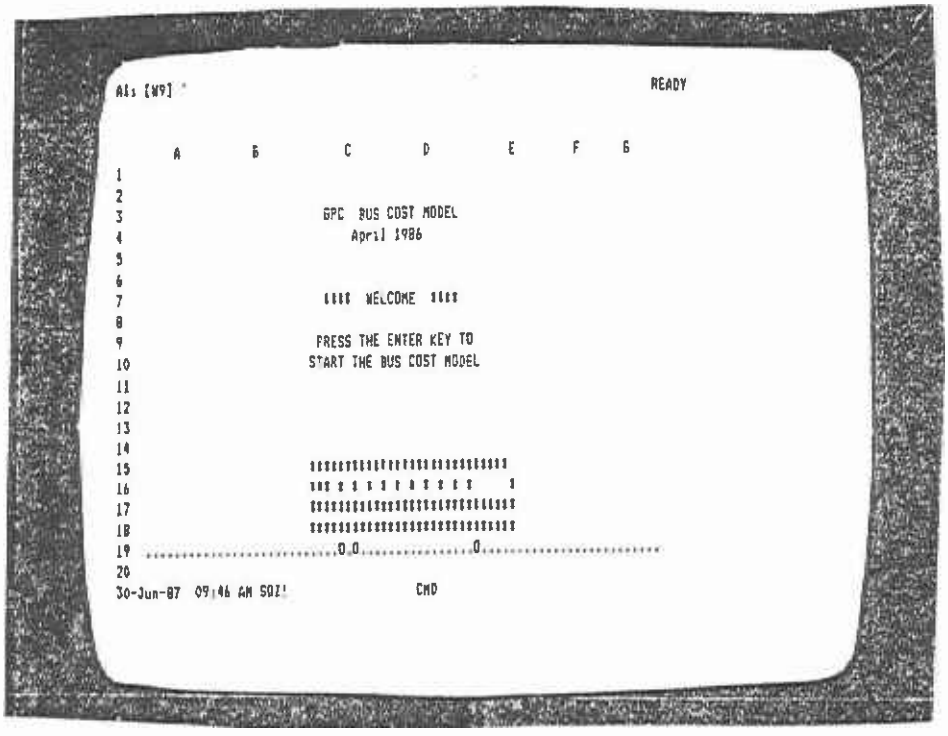


FIGURE II-1.1
INTRODUCTORY SCREEN

2. OVERVIEW OF THE GPC BUS COST MODEL

The bus operating cost model calculates the operating expenses for bus operations associated with either increases or decreases in service. The model generates these estimates from projections of annual bus operating statistics based upon the quantity of service for the whole bus system. The level-of-service (LOS) measures that are used are:

1) Annual vehicle miles,
2) Annual service hours,
3) Average weekday P.M. peak vehicles, and
4) Annual passenger boardings.

The model is a fixed/variable cost allocation model. First, the cost of each budget line item that makes up the District's budget or expense is allocated to one level-of-service (LOS) measure. That is, each budget line item is defined as being dependent on one of the four LOS measures. Second, each line item is defined as being either variable (that is, the line item is expected to vary with changes in the LOS measures), or fixed (that is, the line item will not change irrespective of service changes). Variable line items are labor positions, supplies, materials, and associated costs that can be expected to change as the amount of bus service changes. Fixed-line items are all labor positions, supplies, materials and associated costs that are overheads of operating the District and are not expected to change as the amount of service changes. Variable line items are then defined as varying either continuously or in steps (for example, fuel costs vary continuously with vehicle miles), while wages and fringe benefits for transmission mechanics vary in steps with vehicle miles. The line items that vary in steps are generally those that are associated with labor positions, and the step size is defined as the cost of one full-time or part-time position.

Figure II-2.1 shows the elements involved in creating the bus cost model.

FIGURE II-2.1
BUDGET LINE ITEMS

ANNUAL VEHICLE MILES / ANNUAL SERVICE HOURS	AVERAGE WEEKDAY PM PEAK BUSES	ANNUAL PASSENGER BOARDINGS
STEPWISE VARIABLE ITEMS	VARIABLE ITEMS	FIXED ITEMS
Vary by integer increments or decrements of positions.	Vary with every increment or decrement of the Level-of-Service variable.	Fixed or overhead costs of operation.

The SCRTD bus system consists of a set of garages out of which the buses operate. Each of these garages constitutes a division. The divisions vary in size and perform daily maintenance routines on the buses (cleaning, fuel, simple servicing checks, etc.). There is also a central maintenance facility where major overhauls are performed and a central administrative center where planning, scheduling, and personnel functions are performed. The structure of the operations can be partitioned into those activities that are performed within a single division and those that are performed in centralized facilities which service all the divisions. The cost model also reflects this partition. Those costs associated with operating a division (driver wages and fuel) are allocated at the division level. Each division has different costs, depending on the size of the division and the level of service it provides. However, there are costs associated with the central functions that cannot easily be assigned back to a single division because of their central servicing character. For example, central maintenance, transit police, and timetable printing are activities that are performed for all divisions, and it is hard to allocate these shared or joint costs logically at any more detailed level. Because of this, the cost model allocates costs at two levels, the first being at the level of the individual division, and the second being at the level of the whole system which encompasses all divisions. The spreadsheet actually reflects this partition, and there are two parallel spreadsheets, one for individual divisions and the other for all the divisions. The spreadsheet which allocates costs to all divisions is called the systemwide spreadsheet.

Therefore, it follows that each line has costs of operation which can be partitioned into the costs that can be allocated back to the division within which it operates (the Division cost) and the costs that are joint or shared with all other lines and so are part of the System costs. The cost of running a bus line is therefore broken into two costs:

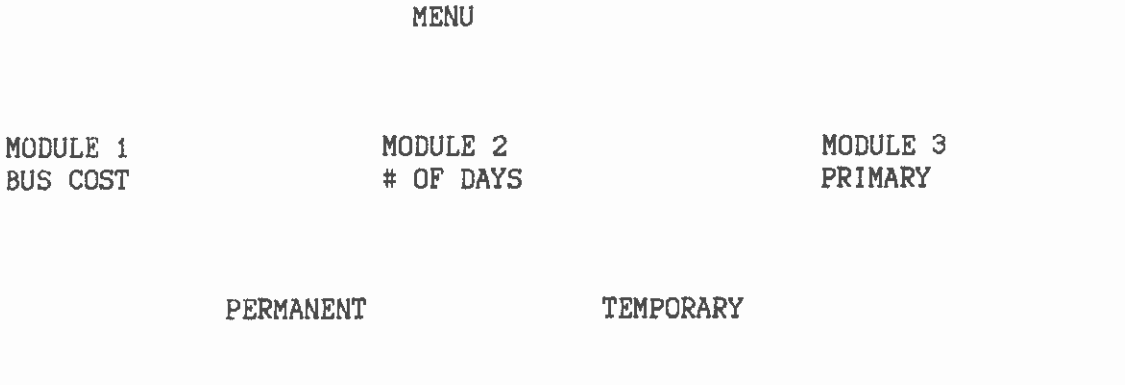
Division Costs	System Costs
(the cost at a single division)	(costs that are shared by all divisions)

The bus cost model has three modules that comprise three LOTUS files. The first module is the actual bus cost model which is the spreadsheet that performs the cost calculations. The second module allows the user to change the number of days of weekday, Saturday, or Sunday service per year. The third module allows the user to create, delete, or reallocate bus lines or divisions. The third module creates a temporary file of changes to the data base which can be accessed by Module 1, the cost model. There is also a permanent data base which cannot be changed except in terms of the number of days being used for the annual calculations. These two files are explained in a little more detail.

The bus cost model uses two large data base files to store the bus line information necessary to perform the cost calculations. The first data base is fixed and is termed the Permanent file. It contains the level-of-service information for each bus line in the RTD system derived from the actual scheduling files. The file can be replaced from time to time

to reflect changes in the District's operation. Only Module 2 can change this file, and then only to modify the number of days (weekdays, Saturdays, and Sundays) in a year used to annualize the daily level-of-service data. The actual number of hours, miles, or peak buses used on a bus line cannot be changed permanently on this file. Module 1 allows the user to modify these data before cost calculation, but the changes are temporary and are never saved on the Primary file. The second data base is created by Module 3 and allows the user to create a copy of the Permanent data base in order to plan new services or to change existing services in various combinations. It is termed the Temporary data base and may be saved at the end of a cost modeling session.

The diagram below sketches the layout of the bus cost model and the relationship between the various modules and the permanent and temporary files.



What The Model Can Do and What It Cannot

This section lists briefly the model specifications and limitations.

The model can:

1) Cost up to fifty extra lines.
2) Create up to four new divisions.
3) Save changes on a temporary file in any one run.
4) Retain the original database file that cannot be changed.
5) Cost one individual bus line or up to fifty individual bus lines in any one run.
6) Delete lines.
7) Create up to fifty bus lines in a run.
8) Create up to four new divisions.
9) Reallocate lines to new divisions.
10) Shut down divisions.

Costing lines individually will give one set of costs. Costing them together as a package will give another set of costs. They are different.

Taking the costs for a set of lines cannot be taken and then broken down by individual line. This is because of the step functions in the cost models.

3. USING THE BUS-COST LOTUS PROGRAM

Once the user is in the LOTUS mode as described in chapter 2, he is ready to use the bus cost model program. To do this, the user calls the main menu screen by retrieving the file AUTO123, using the file-retrieve command /FR. After pressing RETURN and Y keys, the main menu screen, which should look like the figure below, will appear.

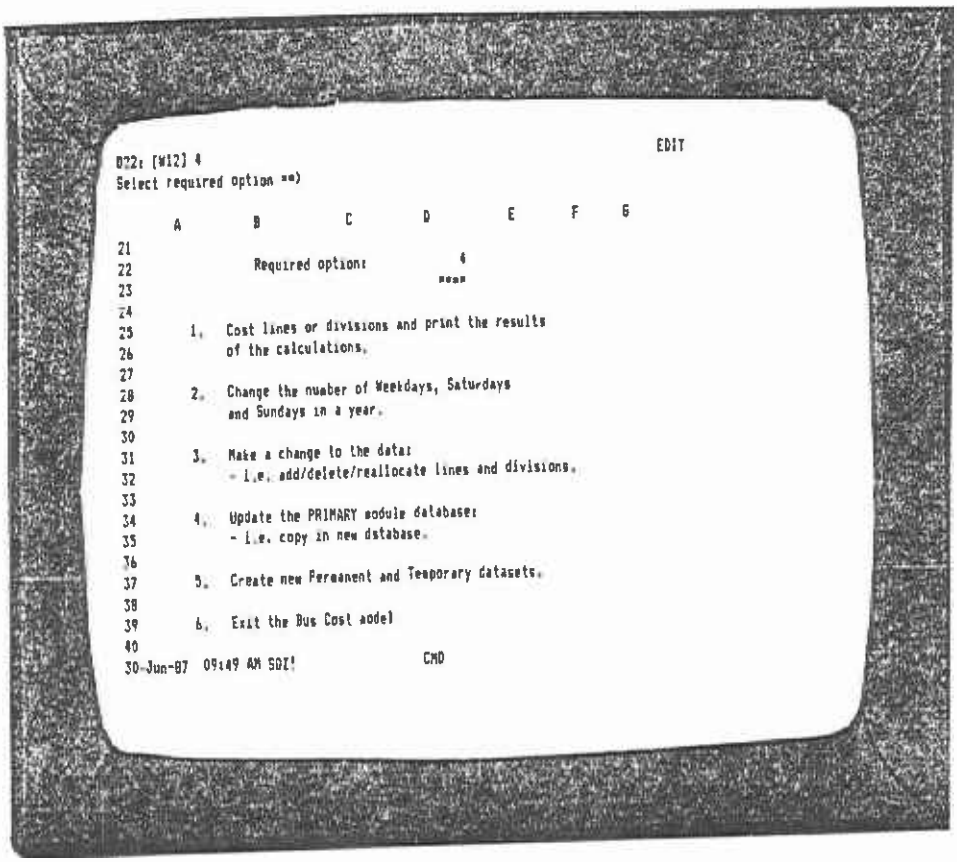


FIGURE II-3.1 THE MAIN MENU SCREEN

The user can then enter the number of the option he wants to execute, which must be between 1 and 6. If the user presses RETURN before entering the option number, an error message will flash on the top right hand corner of the screen. The user should just press the RETURN key again, the error message will disappear and the program will be waiting for him to enter the correct option number. Further steps for executing individual options are given in the remaining chapters of this manual.

4. UPDATING THE DATABASE

Updating the database involves one or both of the following two options:

1) Importing a new database downloaded from the mainframe computer, and/or

2) Creating new permanent and temporary working files for the LOTUS program (PERMDATA and TEMPDATA).

Except for changing the number of days per year, the permanent dataset, PERMDATA, cannot be changed by the program. This is a safety mechanism which assures the user that, whatever changes in line and division data are made during running of the program, the original database will remain unchanged. The temporary database, TEMPDATA, is the one that can be changed by the program to accommodate data modifications by the user when running the program.

4.1 IMPORTING A NEW DATABASE

Two steps are involved in this process.

1) Editing the new database,

2) Copying it into the PRIMARY module

4.1.1 Editing The New Database

The downloaded data file does not normally have the "DAY" column, i.e., the column with WEEK, SAT, and SUN labels against corresponding records. The following steps are necessary to add this "DAY" column into the data:

1) Go into the LOTUS mode, with the floppy disk containing the new file in one of the disk drives;

2) If SQUEEZE is on, the user should switch it off by entering these keys together: <cntl> <shift> <1>. Then enter <s>, <s>, <q> consecutively.

3) Call the new file onto the LOTUS spreadsheet by executing the file-import command:

   /FI(filename)

4) Turn on SQUEEZE again by entering the same keys as in (2) above.

5) Add the "DAY" column by inserting a new column and typing in the WEEK, SAT, and SUN labels in their appropriate rows, so that the data look like Figure II-4.1. Compare this with Figure I-4.6.

WEEK	1	7	352.1	3384.9	25	23770	8900	255
WEEK	2	7	391.9	4537.8	26	23625	8646	255
WEEK	4	6	229.4	2389.3	19	13547	5197	255
WEEK	4	7	413.8	4682.6	23	26549	10186	255
WEEK	10	7	281.8	2762.7	23	19156	7147	255
WEEK	14	1	171.4	2031.8	15	16463	6660	255
WEEK	14	7	217.2	2351.7	17	19055	7708	255
WEEK	16	1	272.8	2560.9	23	24529	8576	255
WEEK	18	1	326.9	3873.4	29	31356	12423	255
WEEK	20	6	255.2	2774.9	22	17261	6601	255
.								
.								
.								
.								
SAT	1	7	277.5	2579.4	0	20994	5457	52
SAT	2	7	295.8	3346.5	0	15186	5933	52
SAT	4	6	221.6	2450.8	0	9299	2496	52
SAT	4	7	303.0	3326.2	0	12621	3388	52
SAT	10	7	176.0	1783.4	0	12819	3284	52
SAT	14	1	116.7	1478.3	0	10693	4230	52
SAT	14	7	103.4	1242.7	0	8988	3556	52
SAT	16	1	229.0	2068.3	0	17517	6194	52
SAT	18	1	275.0	3148.6	0	22836	9362	52
SAT	20	6	121.0	1295.8	0	6265	2408	52
.								
.								
.								
.								
SUN	1	7	252.7	2526.0	0	13325	5120	58
SUN	2	7	276.0	3201.4	0	10046	4008	58
SUN	4	6	215.5	2479.1	0	7450	2098	58
SUN	4	7	243.5	2808.8	0	8441	2378	58
SUN	10	7	148.4	1625.3	0	7454	2853	58
SUN	14	1	82.8	1035.6	0	5597	2207	58
SUN	14	7	86.1	1078.6	0	5830	2298	58
SUN	16	1	179.9	1645.8	0	11366	4386	58
SUN	18	1	218.4	2565.0	0	20163	5630	58
SUN	20	6	102.3	1145.9	0	5498	2116	58
.								
.								
.								
.								

FIGURE II-4.1
THE DOWNLOADED DATAFILE WITH "DAY" COLUMN INSERTED

6) Save the file using the file-save command:

/FSbuscost, where 'buscost' is the new filename.

IMPORTANT: The new edited file should be named 'BUSCOST', because the program to update the PRIMARY database is written to read this file name.

The file is now ready for copying into the PRIMARY module.

4.1.2 Updating the Primary Module Database

Copying the new edited database is an automatic process. The copying is done by selecting Option 4 of the main menu.

Updating the PRIMARY dataset is achieved in the following steps.

1) Call up the bus-cost program main menu as described in chapter 1.

2) Select option 4 of the main menu.

3) The program will prompt the user to confirm whether the new file has been edited or not. If not, the program will return the user to the main menu.

4) The program will take a few seconds to copy the new dataset (buscost) into the PRIMARY module. At the end, the program will return the user to the main menu.

5) Create new permanent and temporary working files, as explained in Section 4.2 below.

4.2 CREATING NEW PERMANENT AND TEMPORARY DATASETS

This is a very short process which involves execution of the following steps twice, once for the permanent dataset and again for the temporary dataset.

1) From the main menu, select option 5.

2) Enter 1 to create a permanent dataset, or 0 (zero) to create a temporary dataset.

3) The program will then prompt you to enter the total number of weekdays, Saturdays, and Sundays. Note that this information is not used anywhere for computation, since each line has its own number of weekdays, Saturdays, and Sundays.

4) The program then creates the dataset and, at the end, brings you back to the main menu.

5) The above steps are repeated to create the other dataset.

5. CHANGING THE NUMBER OF DAYS

Changing the number of days of operation for a given line or a number of lines can be done by selecting option 2 from the main menu. The following sequence of steps must be executed.

1) Select Option 2 from the Main Menu.

2) Select 1 or 0 (zero) to enter the changes into the permanent or temporary files respectively.

3) At this point, the program will prompt the user to enter the line number and the new number of weekdays, Saturdays, and Sundays. If the change is to be effected for all the lines, then enter 0 (zero) as the line number. To make changes to only some of the lines, this step has to be repeated once for each line to be changed. The user can change as many lines as he likes.

4) If the user enters a line number that does not exist or does not operate on some of the days, he will get an error message. The user will then be prompted to enter the BREAK key and then choose to continue or re-enter the line number by entering C or E respectively. Therefore, if the user wants to change the number of days for a line that only operates on weekdays, he will get an error message when the program tries to search for the line for Saturdays and Sundays. In this case, he should just enter BREAK and C to continue. If, on the other hand, he has entered a line number that does not exist, he will have to enter BREAK and E to be able to enter the correct line number.

5) The program will then make the changes into the permanent or temporary dataset, as specified, and will return to the main menu.

6. COSTING LINES AND/OR DIVISIONS

This chapter describes how to use the Bus Cost model to cost a bus line or a set of lines.

Option 1: Costing an existing bus line or set of bus lines.

Step 1. Select option.

The user should have the main menu screen. The menu should look like figure II-6.1. You should select option 1 from the main menu to perform the costing of lines and divisions.

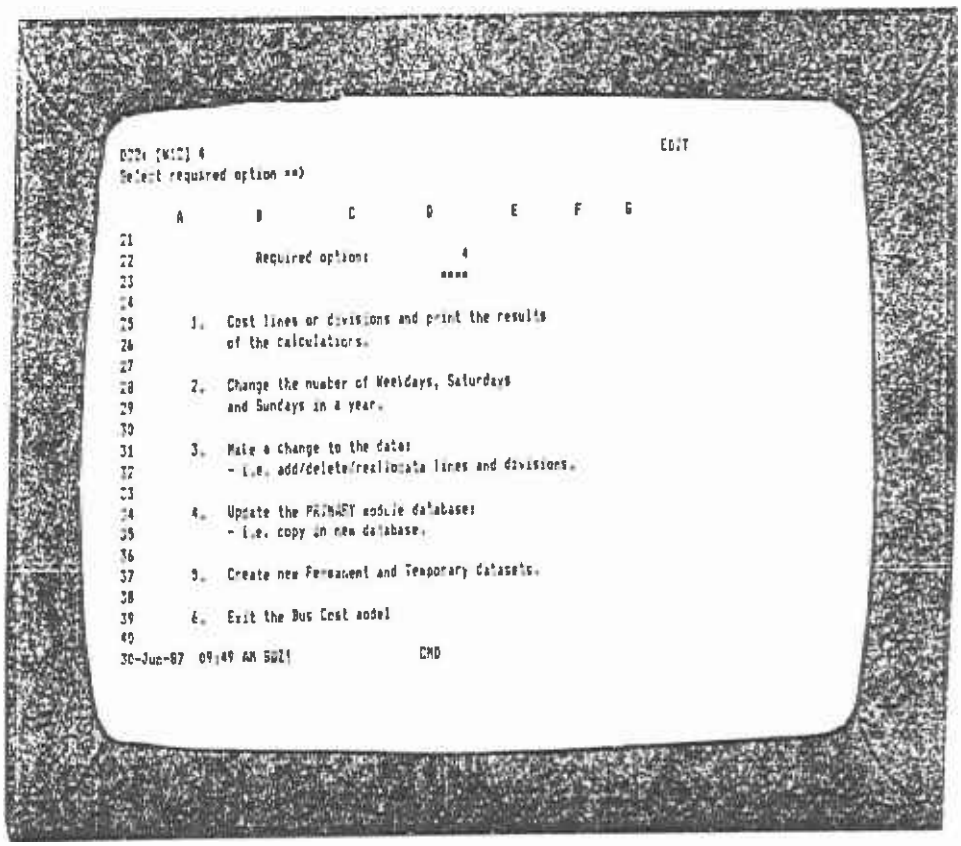


FIGURE II-6.1 THE MAIN MENU SCREEN

Step 2. Select use of permanent or temporary files

When the Bus Cost file is loaded and ready for calculation, the next screen will appear (Figure II-6.2). The prompt on the second top line asks the user if he wishes to use the permanent or temporary data sets. To cost an existing line, the user should use the permanent data set, and so type the number 1 and press Return. Should an error in the entry process be made in this step, an error message will flash on the top right of the screen. As in step 1, should this occur, just press Return again and then enter the number 1 and press Return again. The LOTUS program will now retrieve the permanent data set and incorporate it into the spreadsheet. This will take a few seconds, and part of the data base can be seen on the screen while this is in progress.

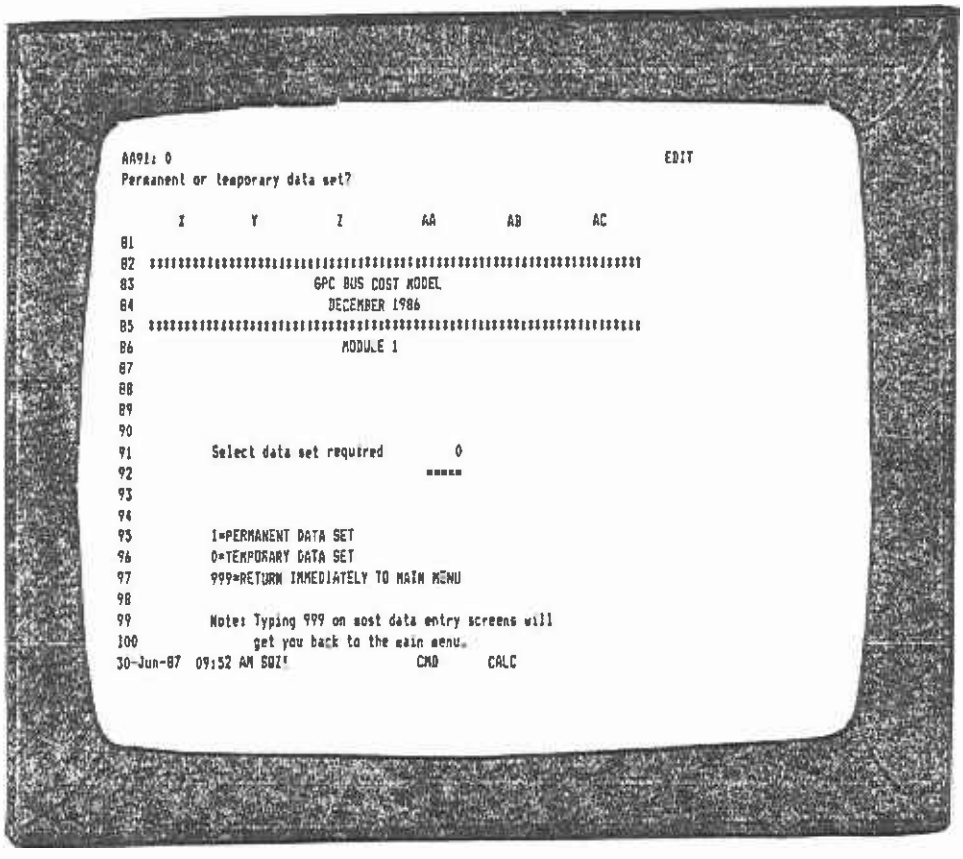


FIGURE II-6.2

Step 3. Selection of lines or divisions to be costed.

The next screen (Figure II-6.3) asks the user whether he wishes to cost all divisions. If 'yes' is entered, the program would then calculate the cost of running the entire bus system.

To cost a line or set of lines, type the letter N and press return.

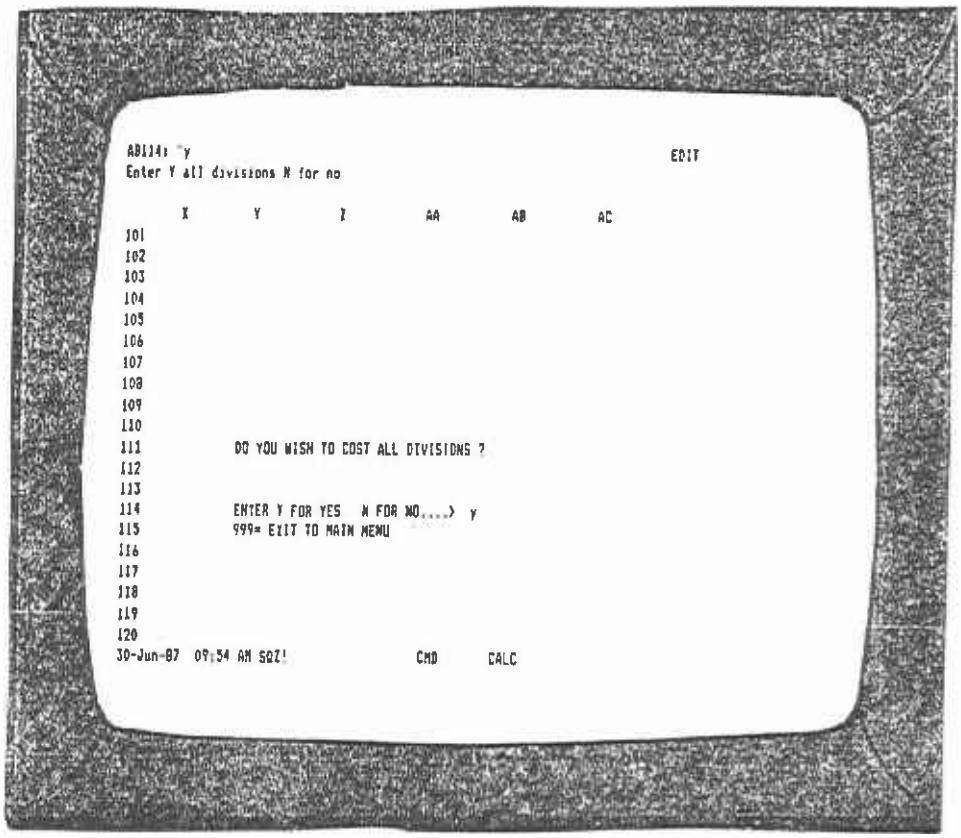

AB114: "y
EDIT
Enter Y all divisions N for no
X
Y
I
AA
AB
AC
101
102
103
104
105
106
107
108
109
110
111
DO YOU WISH TO COST ALL DIVISIONS ?
112
113
114
ENTER Y FOR YES N FOR NO....> y
115
999= EXIT TO MAIN MENU
116
117
118
119
120
30-Jun-87 09:54 AM SQZ!
CMD
CALC

FIGURE II-6.3

Step 4. Costing by line or division.

The program now asks the user whether he wishes to cost a line or set of lines, or a division or set of divisions (see Figure II-6.4). The entry procedures are similar in both cases.

In the case of costing divisions, the program would be calculating the cost of operating all bus lines in the division specified. To cost a bus line, the number 0 is entered.

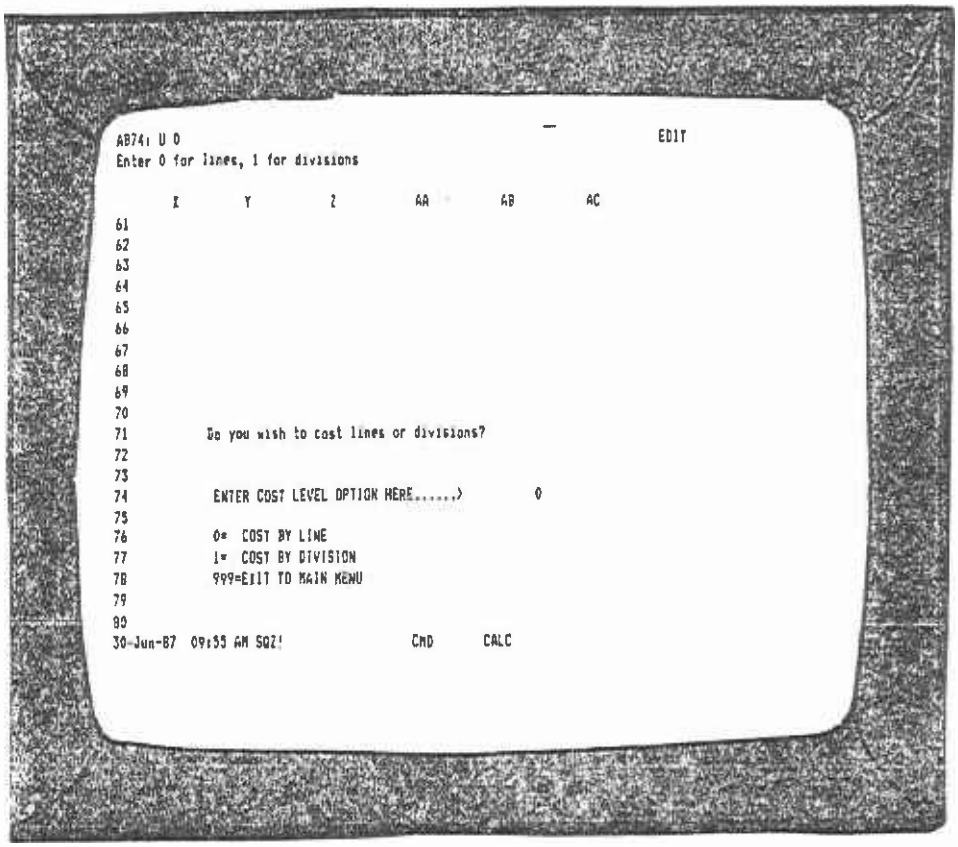


FIGURE II-6.4

Step 5. Select line or division number.

The next screen (Figure II-6.5) requires the user to specify the bus line number and the day of the week that is required for costing. The user can enter a number under the LINE column. Use the right directional movement key to move the cursor over to the DAY column. In the example, we have selected bus line number 30. We entered the number 30 and then pressed the right direction key to move over to the DAY column. Since we wanted to cost the bus line for weekdays, Saturdays, and Sundays we entered a * in the DAY column. If we had wanted to cost weekday service only, we would have typed in WEEK. It is important to enter the DAY in upper case, otherwise the program will not be able to calculate the line costs.

If there are no further lines to be costed, press Return twice.

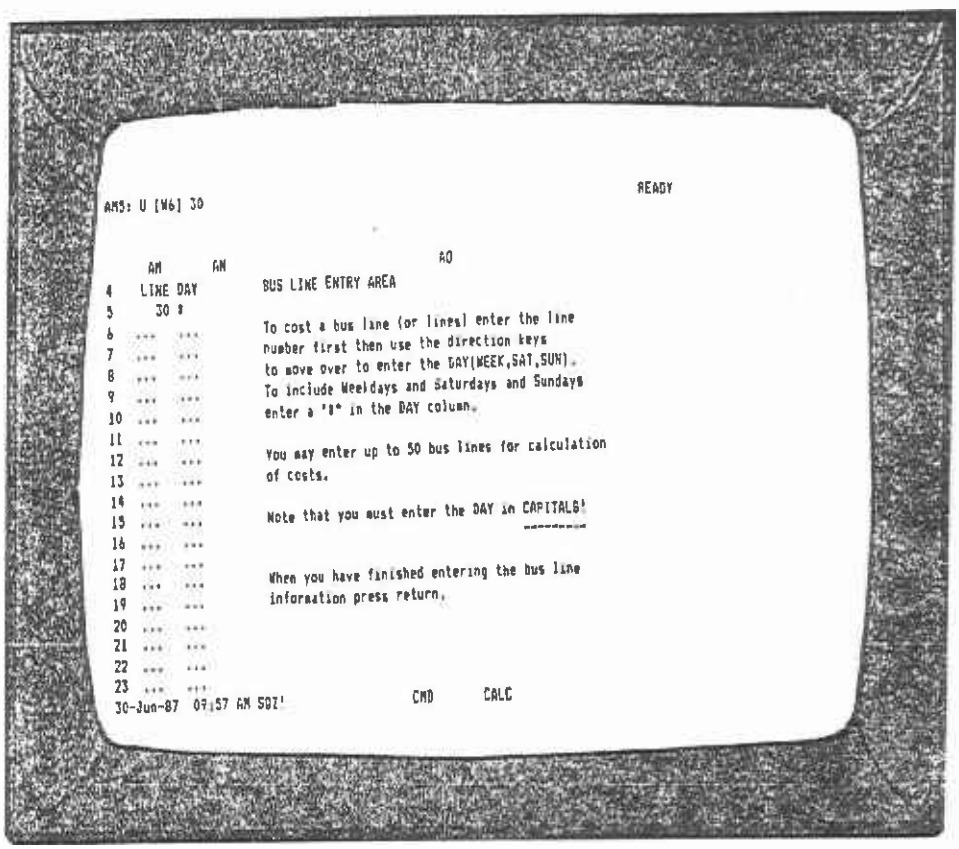


FIGURE II-6.5

After entering the line number and day of the week, the next screen (Figure II-6.6) provides an opportunity to review the selections and make any changes before the costing process begins. When costing only a few lines, this may seem unnecessary. However, if a package of some twenty or so lines is being costed, this review feature can help minimize mistakes.

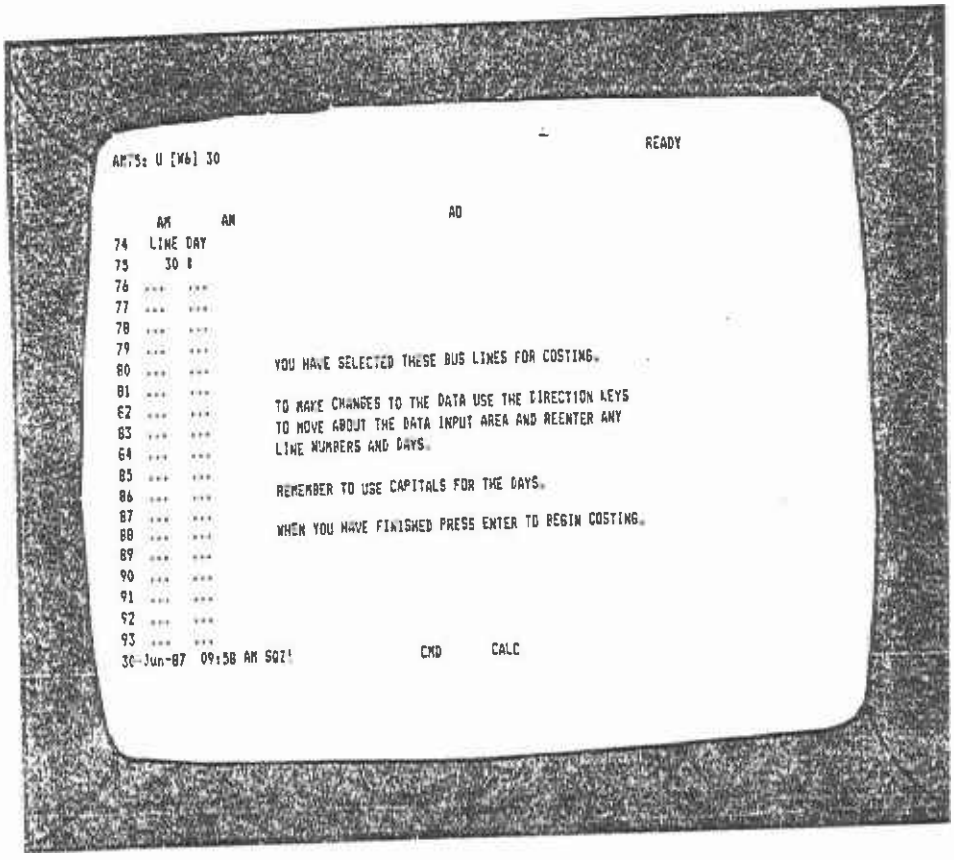


FIGURE II-6.6

Step 6.

This step involves no user input. The screen (Figure II-6.7) simply advises the user that searching the data base may take time. The more lines specified, the longer the search time. Just be patient.

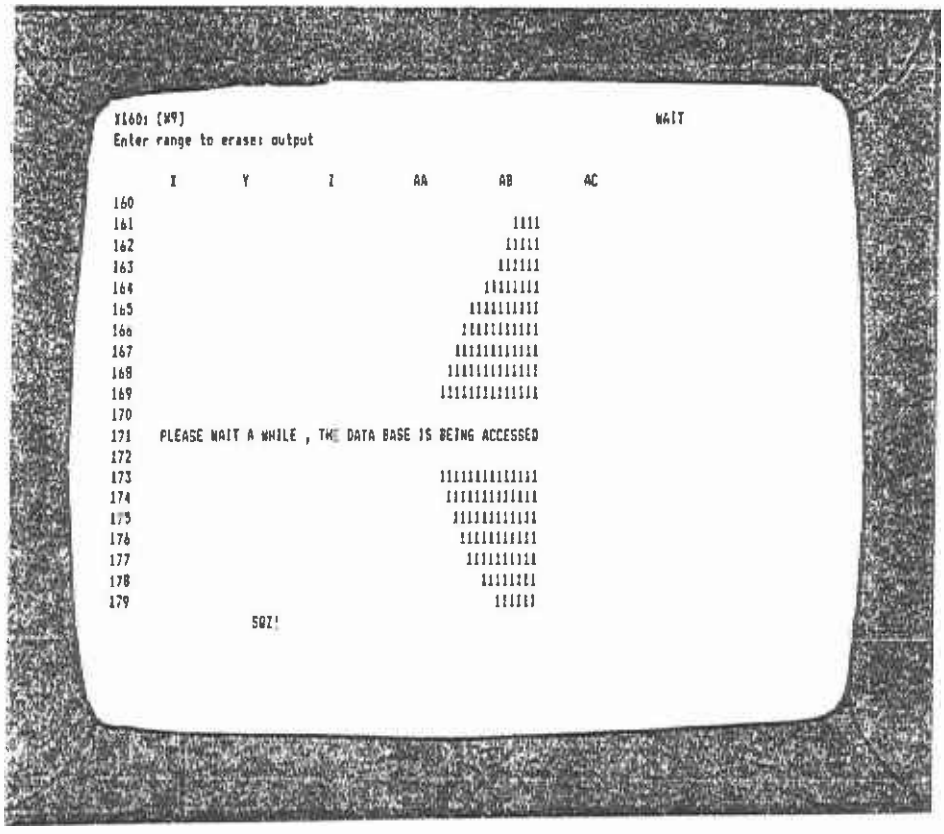


FIGURE II-6.7

Step 7. Changing existing levels of service.

At this point in the costing process, the current bus hours, miles, PM Peak Buses, Passengers, and Revenue for the lines you specified have been retrieved from the data base. The next screen (Figure II-6.8) asks if the user desires to change the existing level-of-service data. The change is made only in this current calculation and is not saved, nor is the permanent database altered. The prompt on the second line from the top asks the user to enter a Y if he wishes to change the data, or an N if he does not. If Y is entered and return is pressed, the next screen allows the user to modify the level-of-service characteristics of each bus line specified for costing.

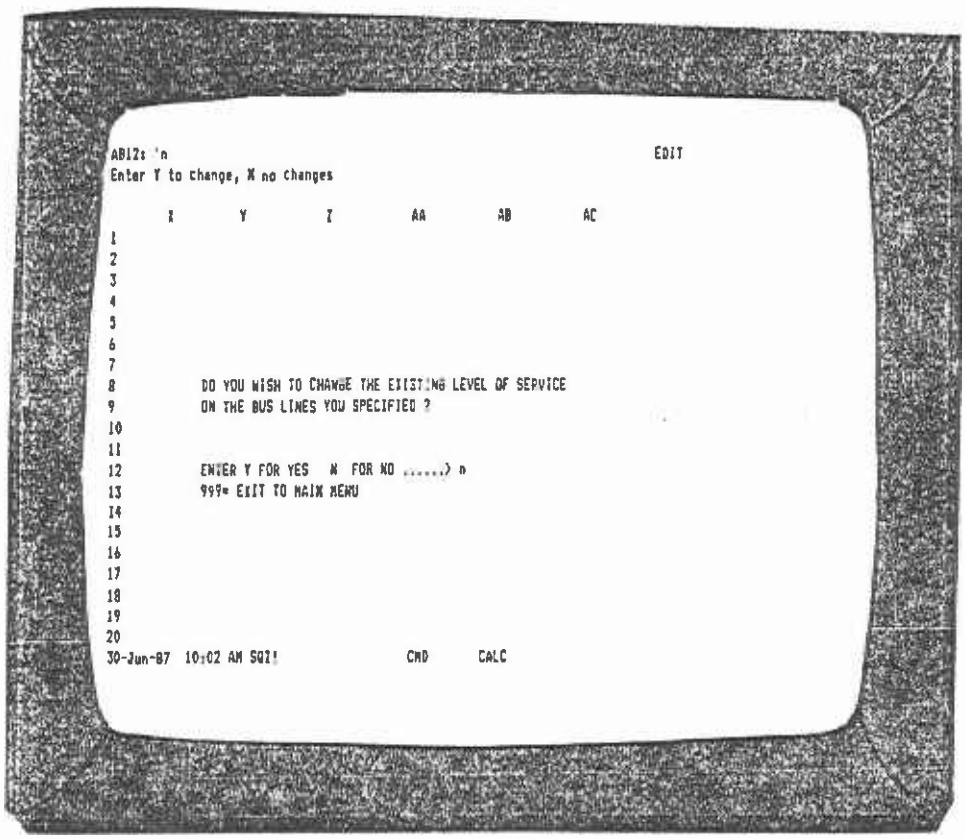


FIGURE II-6.8

If Y was entered, then the next screen will look like Figure II-6.9. The data for the first line specified is displayed under annual existing week. First, enter the day of the week to which the changes apply, and then press Return. The program will calculate the daily level-of-service data based on the day of the week specified. The cursor is positioned under New Data. Enter the changes for daily level of service. Use the cursor keys to move up and down the column. When all items have been entered, press return twice to bring up the next set of bus line data (if multiple lines were specified). Otherwise, enter 0 on the last entry line and press Return. This will cause the program to cease modifying the level-of-service data.

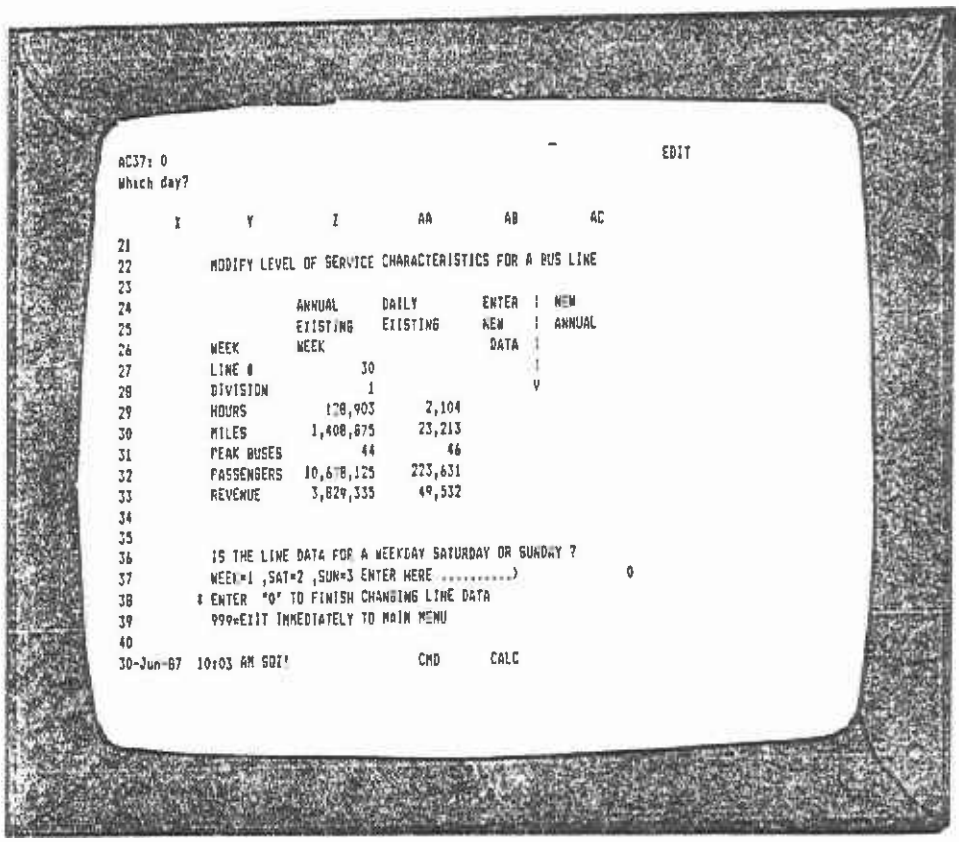


FIGURE II-6.9

Step 8. Printing the output.

The next six screens pertain to printing out the line cost data. The first of these screens (Figure II-6.10) permits the user to view the level-of-service data. Enter SU (screen up) or SD (screen down) to view the data set. The prompt asks for a Y to print the data set, or N to omit printing. Other valid entries are SU or SD to view the data, or 999 to return directly to the main menu.

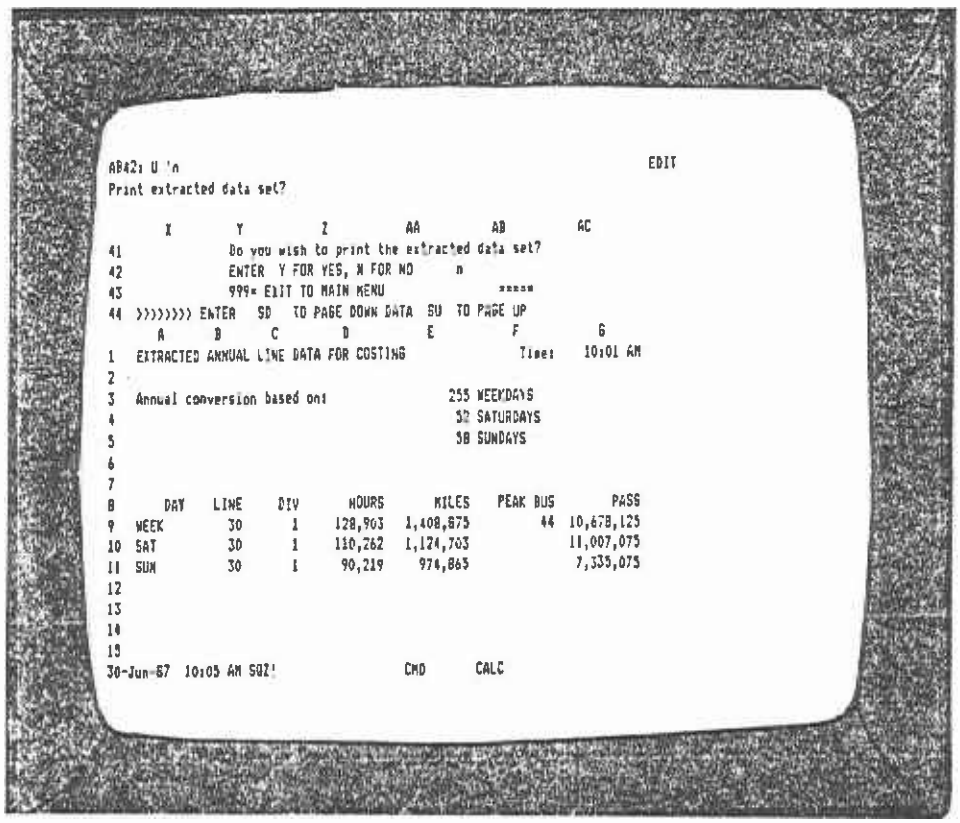


FIGURE II-6.10

The next screen (Figure II-6.11) displays the costs for the bus line that can be allocated to the divisions from which it is operated. This is not the total cost of operation, because the costs allocated to the overall system which cannot be properly broken down are not yet included. Screen 12 presents the marginal costs for the division out of which the bus line operates. It also presents an itemization of the costs attributable to peak service (PM Peak Buses), hours of operation, and miles. At the bottom of the screen, the actual level-of-service data are provided. In the example shown on screen 12, the division being costed is Division 1, and only 1 bus line is evaluated (bus line 30). On the second line from the top, the prompt asks if the user desires a print of this screen. Enter Y (do) or N (do not) and press Return. A second prompt is given which asks the user to align the paper and press return to commence printing.

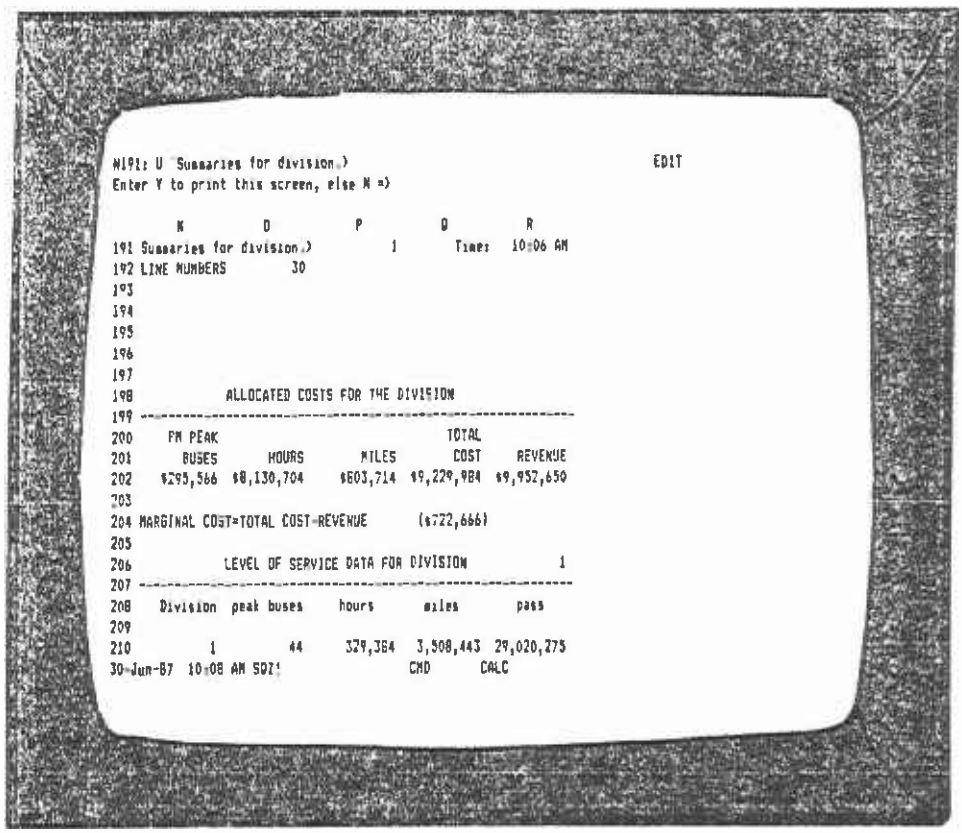


FIGURE II-6.11

The following screen (Figure II-6.12) appears similar to the preceding screen. The division cost information is identical, but the prompt on line 2 now asks if a printout of the divisional spreadsheet is required. Enter Y or N as in the previous screen and press Return.

Should a number of bus lines be specified which operate out of more than one division, then Figures II-6.11 and II-6.12 would be repeated for each division.

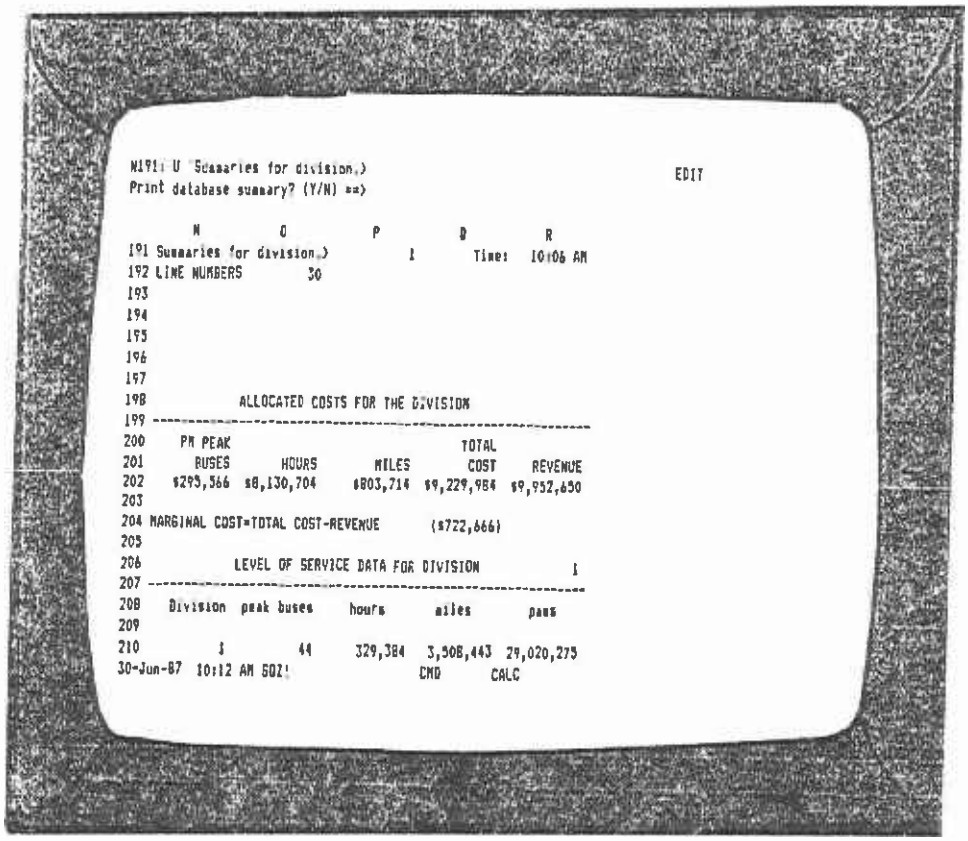


FIGURE II-6.12

The next screens (Figures II-6.13 and II-6.15) contain the information for the last division that was costed, but prompt the user for a printout of the database, cost summary, and the system calculation. The prompts are identical to those discussed before.

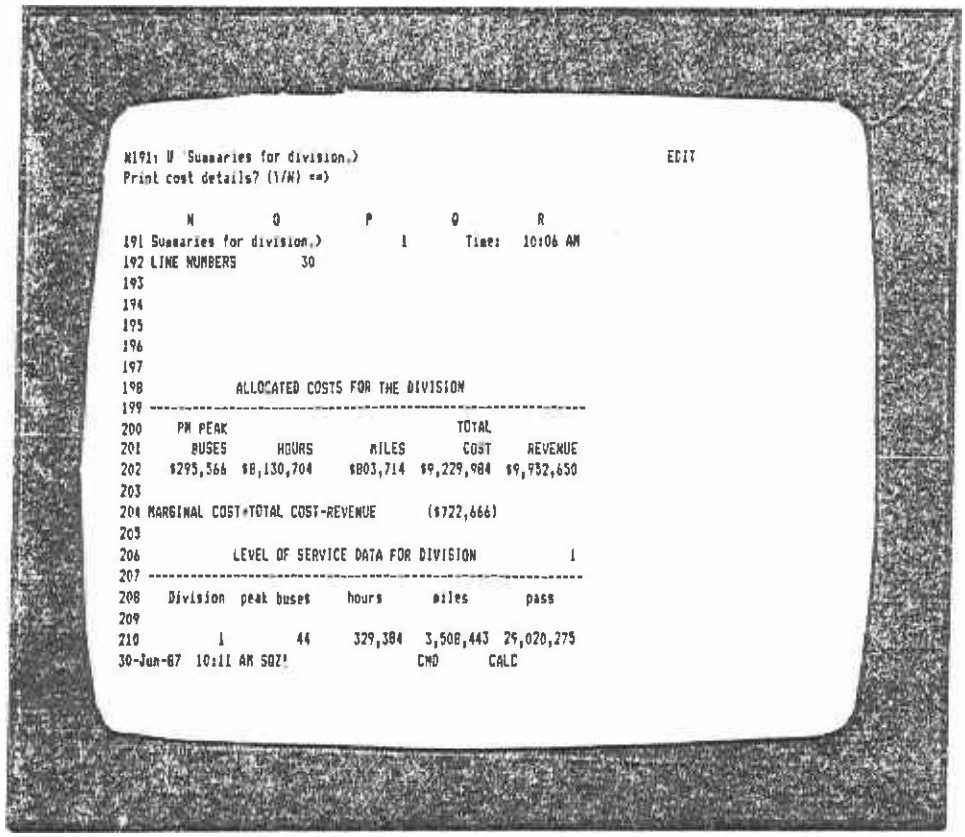
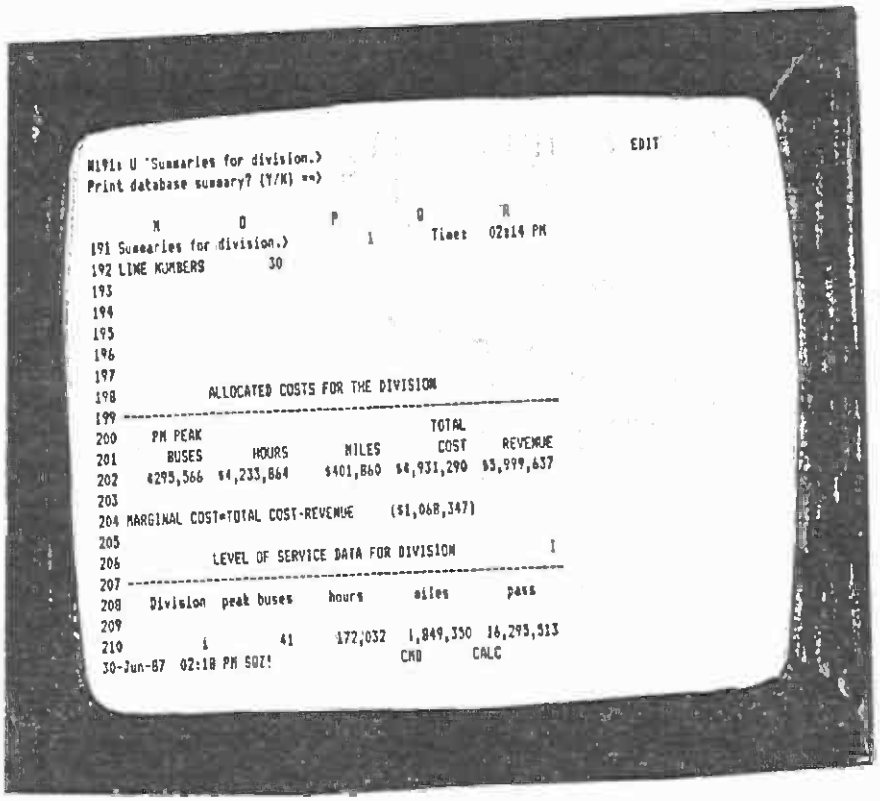
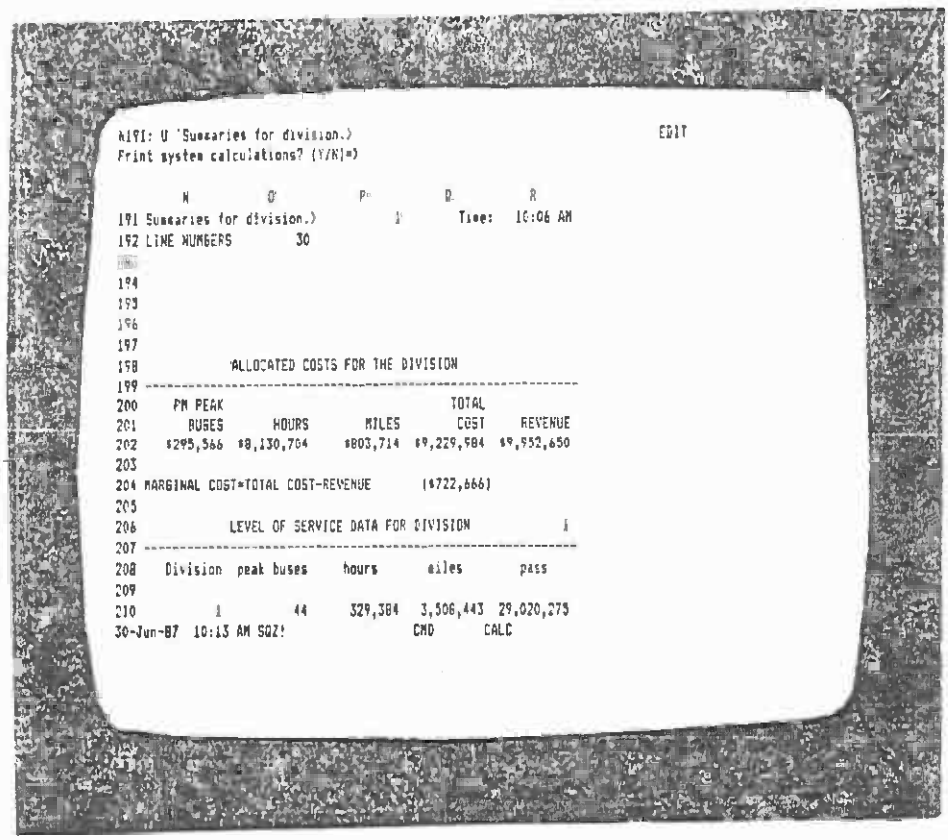


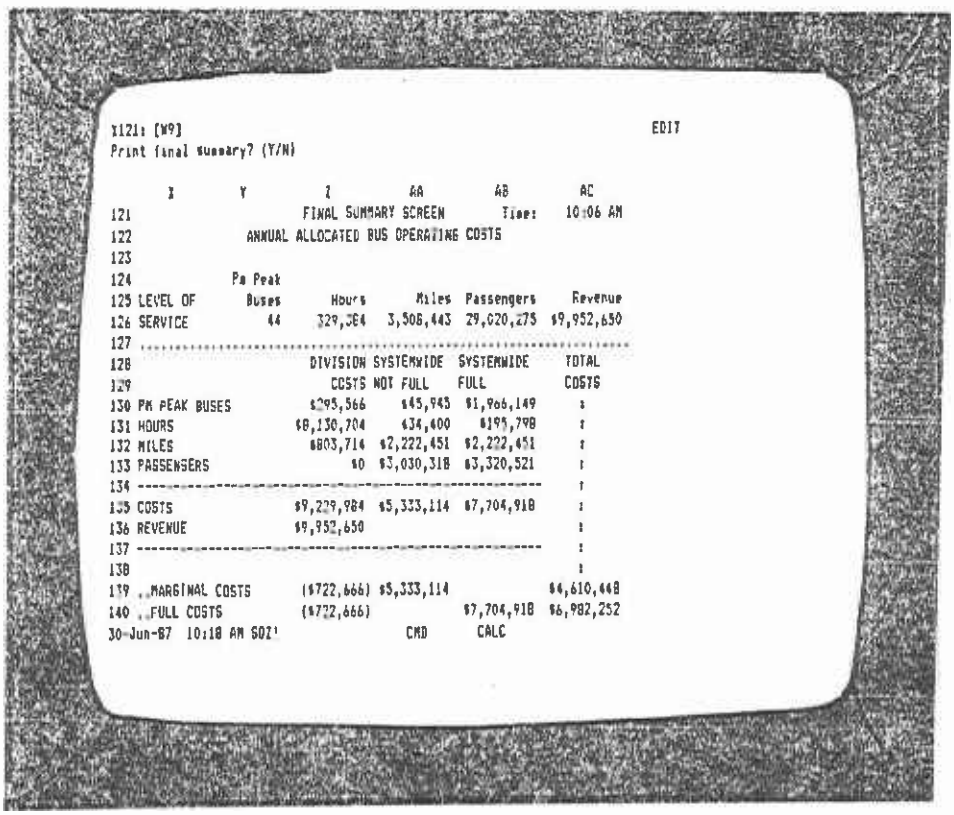
FIGURE II-6.13





FIGURES II-6.14 & II-6.15

The second-last screen of this module (Figure II-6.16) is important because it contains the total cost information for all lines. It has the total costs allocated to each division specified and the costs that were allocated among all the divisions (systemwide). The last two lines provide the marginal and full cost information for the lines specified.



```
X121: [W9]                                                        EDIT
Print final summary? (Y/N)

      I        Y         I          AA         AB         AC
121                  FINAL SUMMARY SCREEN       Time:   10:06 AM
122             ANNUAL ALLOCATED BUS OPERATING COSTS
123
124            Pm Peak
125 LEVEL OF     Buses      Hours       Miles  Passengers    Revenue
126 SERVICE         44    329,384   3,506,443  29,020,275  $9,952,650
127 ..........................................................------
128                      DIVISION SYSTEMWIDE  SYSTEMWIDE      TOTAL
129                        COSTS NOT FULL     FULL            COSTS
130 PM PEAK BUSES          $295,566    $45,945  $1,906,149        :
131 HOURS                $8,130,704   434,400    $195,798        :
132 MILES                  $803,714 $2,222,451 $2,222,451        :
133 PASSENGERS                  $0 $3,030,318 $3,320,521        :
134 ---------------------------------------------------------    :
135 COSTS                $9,229,984 $5,333,114 $7,704,918        :
136 REVENUE              $9,952,650                              :
137 ---------------------------------------------------------    :
138                                                              :
139 ..MARGINAL COSTS      ($722,666) $5,333,114           $4,610,448
140 ..FULL COSTS          ($722,666)           $7,704,918 $6,982,252
30-Jun-87  10:18 AM SOZ'              CMD       CALC
```

FIGURE II-6.16

Step 9. Return to main menu or cost another line/division.

The final screen (Figure II-6.17) asks the user if he wishes to return to the main menu or continue costing bus lines from the permanent data set.

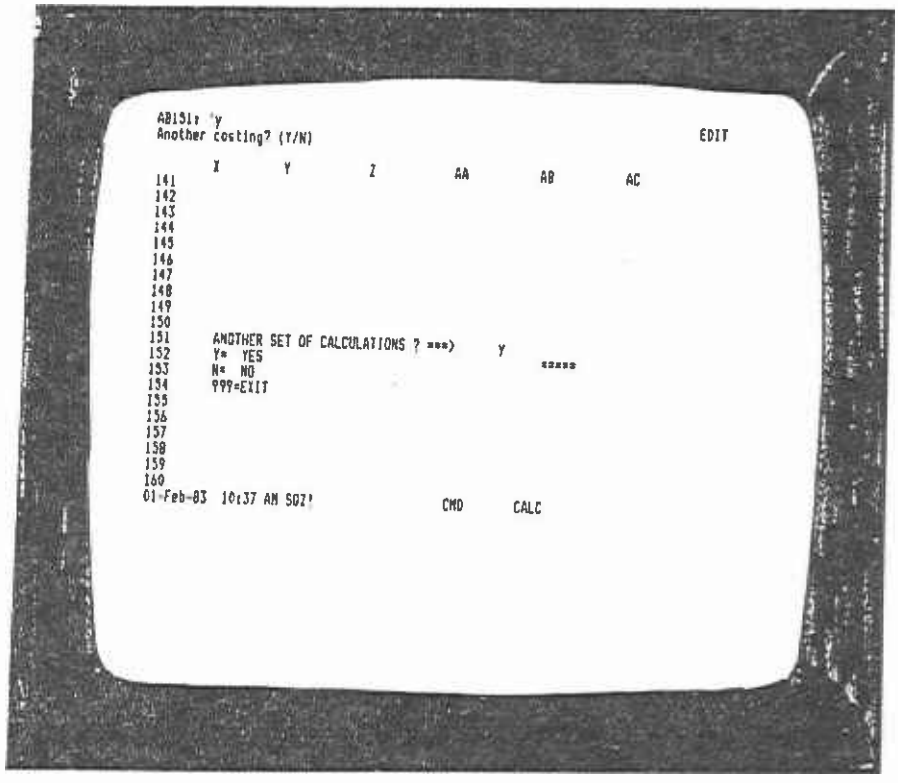


FIGURE II-6.17

Option 2: Costing an existing bus division or set of bus divisions

The procedure to cost an existing division or set of divisions is similar to costing bus lines. The screens are almost the same, with a few minor wording changes.

Steps 1, 2, and 3.

Repeat the procedure exactly as for costing an existing bus line.

Step 4.

On this screen (Figure II-6.18) press the number 1 and then Return in order to cost a division.

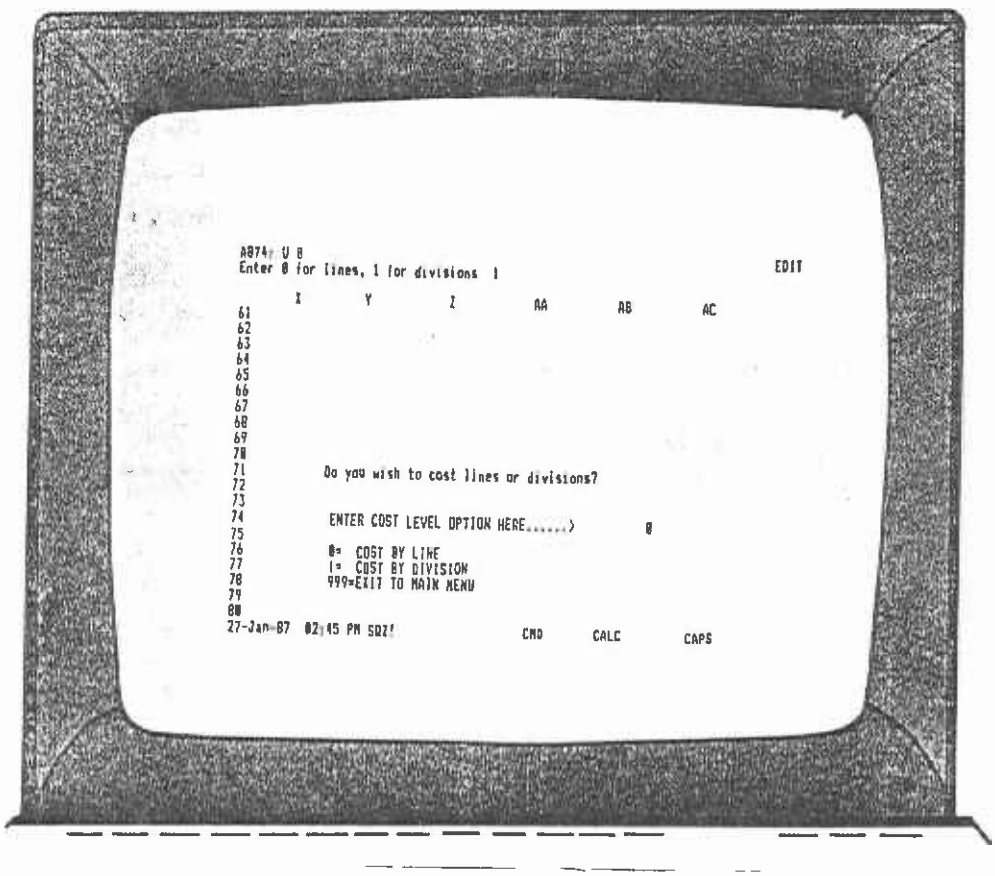


FIGURE II-6.18

Step 5.

The next screen (Figure II-6.19) requires the user to enter the division number and the day of the week that is required for costing. The user can enter division numbers under the DIV column. Use the right directional movement key to move the cursor over to the DAY column and enter the desired day of the week. In this example, the choice is to cost division 1 for weekdays, Saturdays, and Sundays.

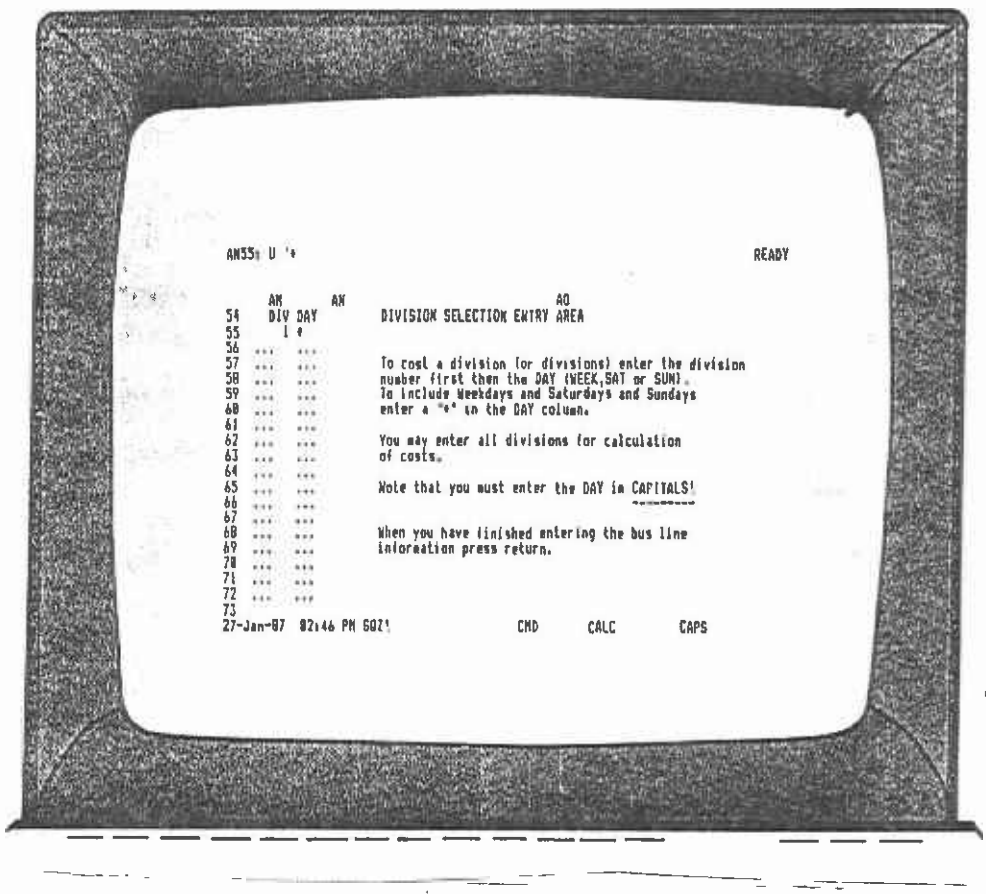


FIGURE II-6.19

After the division numbers are numbered, the next screen provides a checking facility which is useful if the user has entered several divisions for costing.

Steps 6 and 7.

Same as for costing an existing bus line

If the user decides to change line data, he will be changing the level-of-service data for those bus lines operating out of the divisions the user nominated in step 5. In this case, it is the bus lines running from division 1.

Step 8 and 9.

Same as for costing an existing bus line.

7. MODIFYING THE DATABASE

Option 1: Adding a bus line or lines.

Step 1. Main menu.

If you do not have the main menu up on the screen, go to chapter 1 now.

Step 2. Module 3 options.

When the Primary file is loaded and ready for calculation, a screen like Figure II-7.1 will appear, notifying the user that he is in Module 3 which allows him to change the temporary database by adding, deleting, or reallocating bus lines. Press Return to move on to the menu screen.

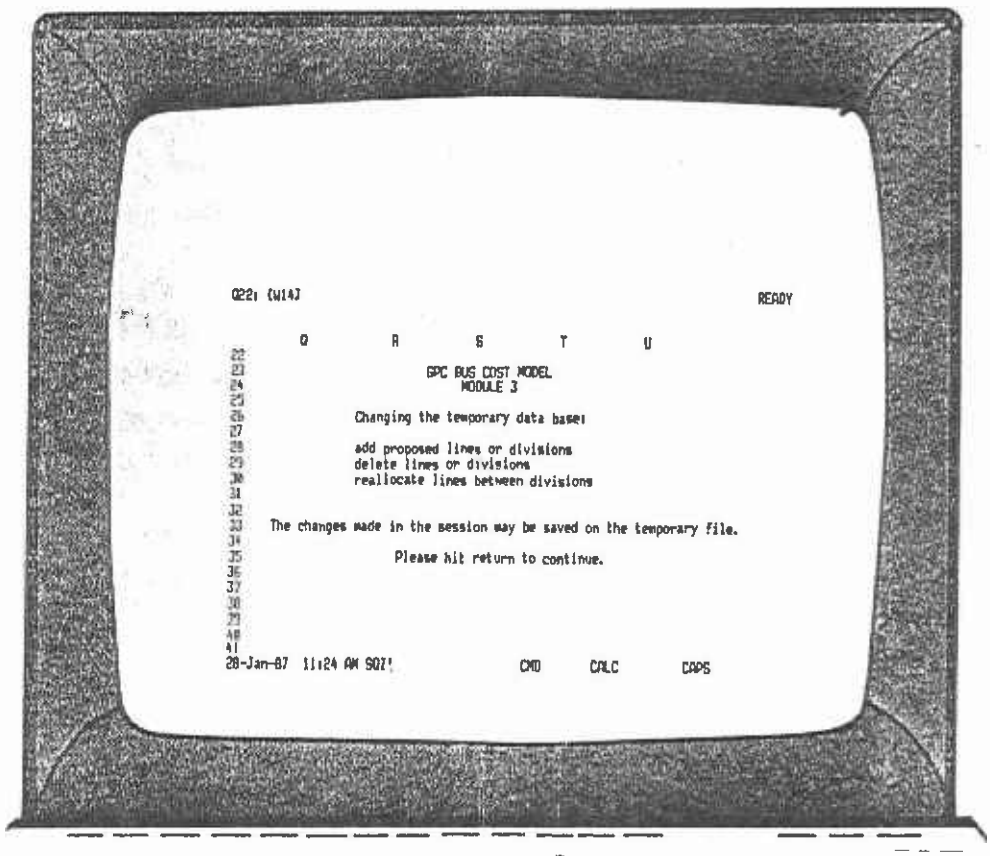


FIGURE II-7.1

Step 3. Select option.

Figure II-7.2 has a menu displayed on the second top line. Under this line is a brief description of the menu item. Use the direction keys to review each of the menu selections:

1) Add (add a line or division)
2) Delete (delete a line or division)
3) Reallocate
4) Undo
5) Cost

Since the user wishes to add a line, move the cursor over the menu to ADD and press Return.

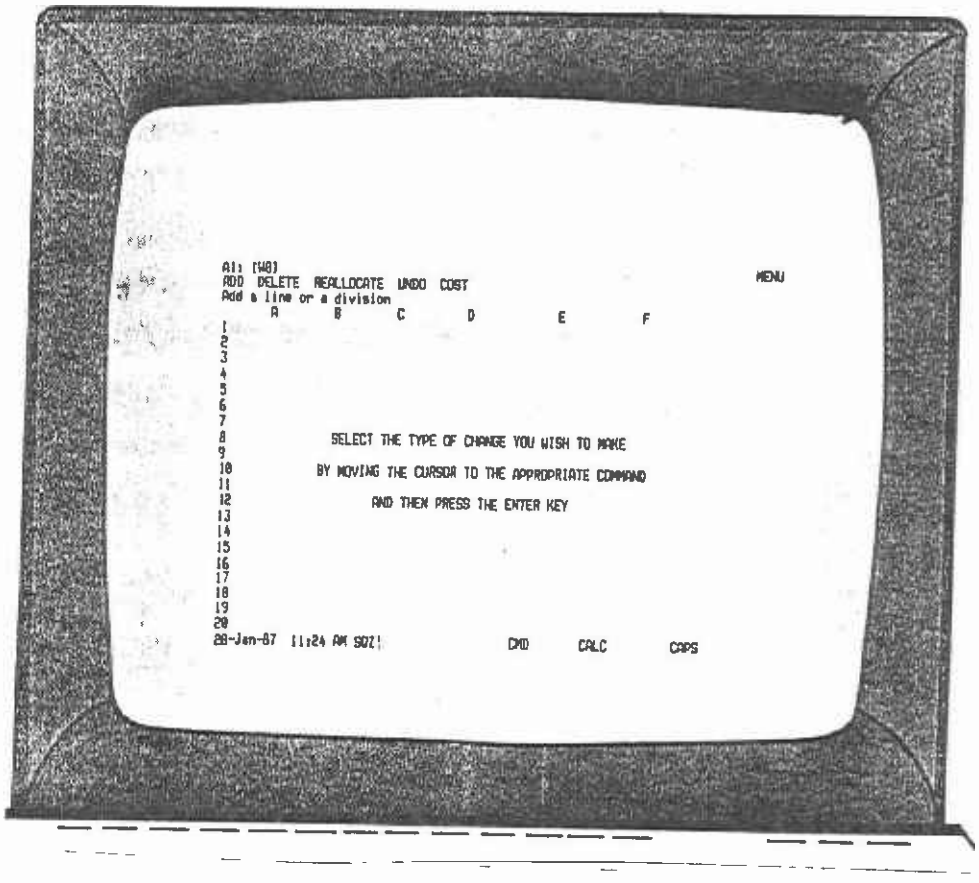


FIGURE II-7.2

Step 4. Select line or division.

The next screen (Figure II-7.3) asks whether the user wishes to add a bus line or a division. Both procedures are similar, but since the user wishes to add a line, press Enter, because the cursor should already be resting on LINE. If it is not, move the cursor back to LINE and press Enter.

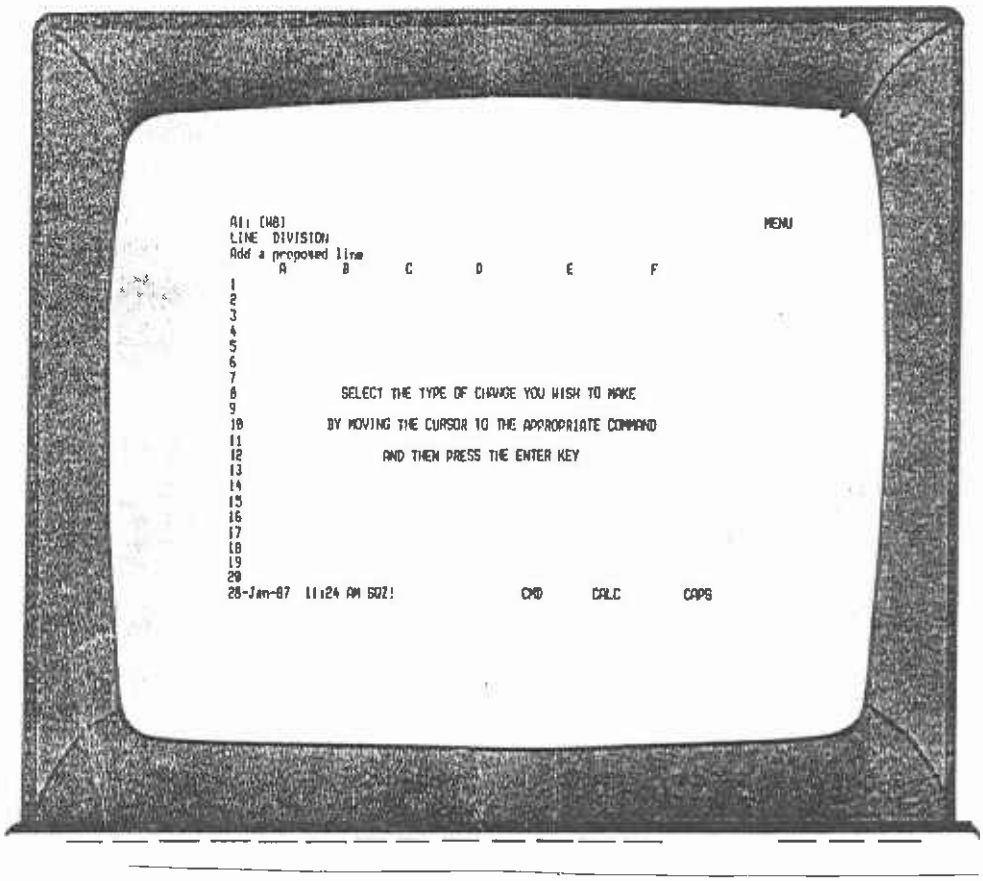


FIGURE II-7.3

Step 5. Data entry.

Figure II-7.4 is a data entry screen. When the 'ready' sign appears in the top right-hand corner, the user can begin entering daily level-of-service bus line data. The cursor will be resting to the right of the line number. Enter the number of the new bus line here and press the 'down' arrow key to move to the next item, which is Days. The bus line numbers must be between 800 and 849. In any one run, the user can enter up to fifty new bus lines. Figure II-7.5 shows a completed data entry screen. The annual totals column is calculated by the spreadsheet. The user needs only to enter daily information. Note that the annual totals are based on the daily totals multiplied by the number of days in the year that was entered. If by accident the user enters a line number that is not between 800 and 849, an error message will appear at the bottom of this screen and the user will be required to enter the data again. Be sure to enter the day of the week (WEEK SAT SUN)in upper case letters.

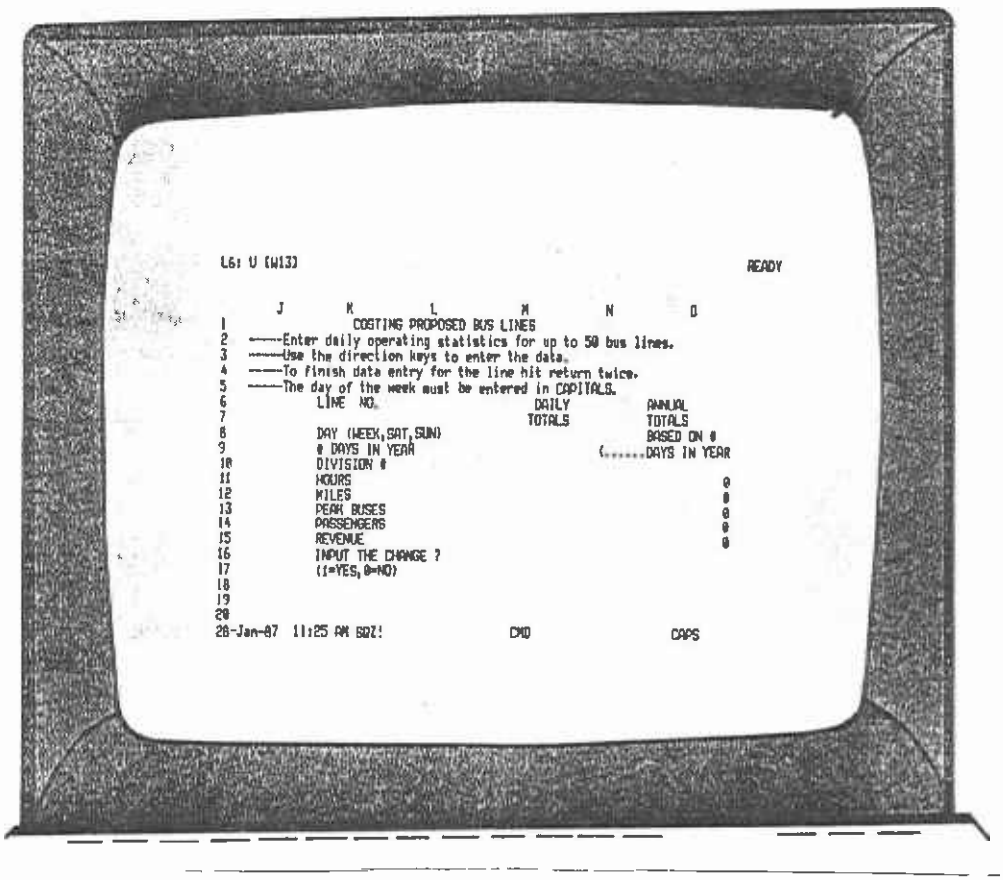


FIGURE II-7.4

When the bus line data entry is completed, press Return twice and a prompt will appear at the second top line inquiring whether the user wishes to create another line. If the user wishes merely to cost this one line (801), he enters 0 and presses Return.

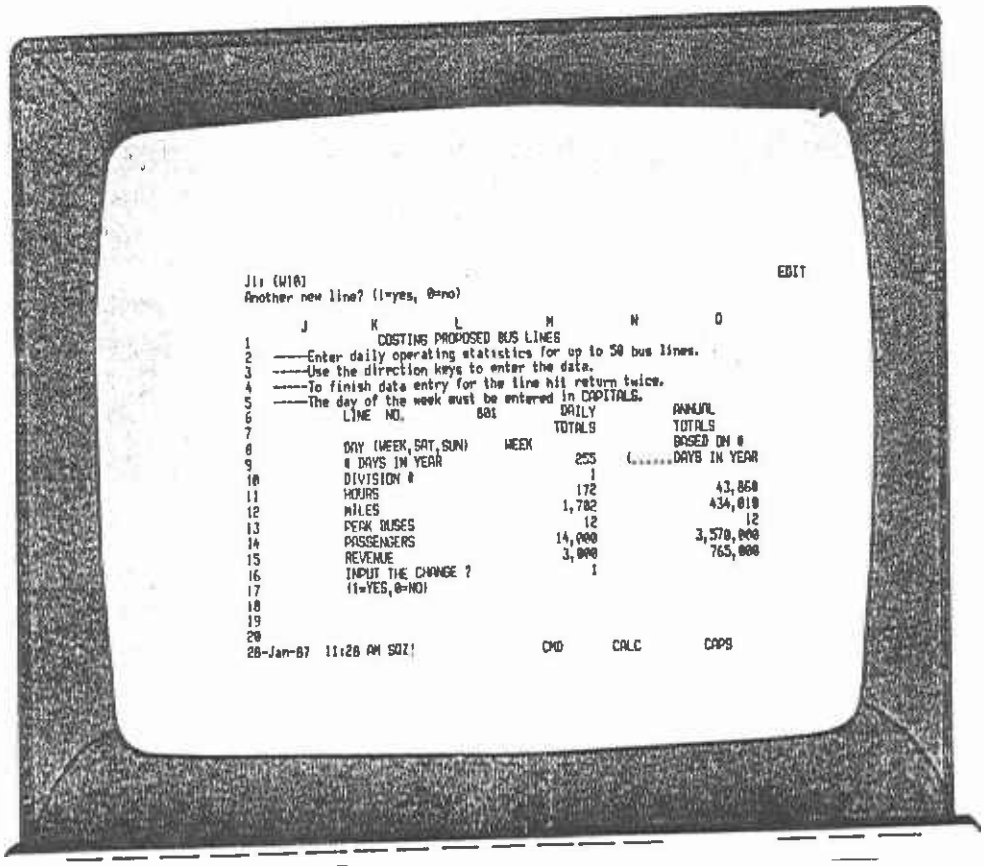


FIGURE II-7.5

Step 6. Costing the new line or division.

Figure II-7.6 is the menu screen and is identical to Figure II-7.2. The next step is to cost the bus line that has been created. Move the cursor to the COST menu item and press Return. To move the cursor, use the directional arrow keys.

It is important to note that the process of costing the bus line includes a file save command at the beginning, which saves the changes made in module 3 on the temporary file. The bus cost spreadsheet can then retrieve this file and the newly created data. If, instead of doing this, the user chooses to exit from Module 3 by pressing the EXIT item, the changes he had made would not be saved on the temporary file and would be lost.

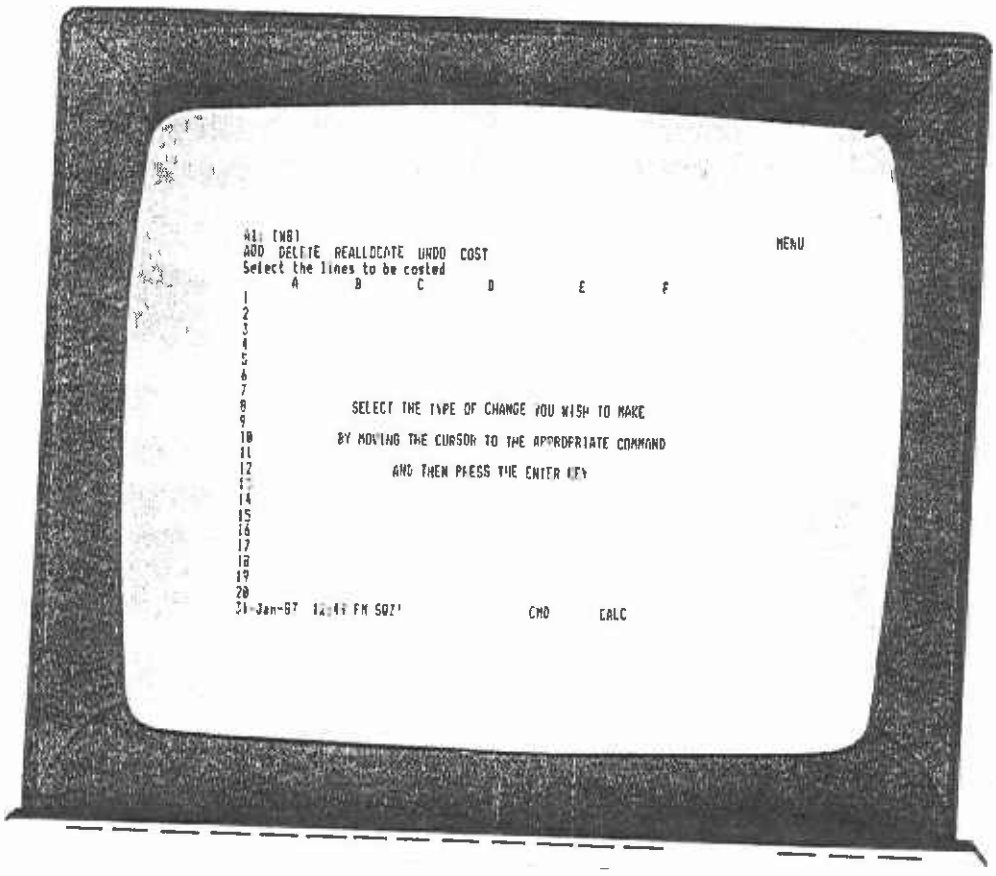


FIGURE II-7.6

Step 7.

The next screen to appear is the beginning of Module 1, the bus cost program. Proceed as for costing an existing line or set of lines. However, remember to select the temporary file in step 2 by typing a 0. At step 5, simply enter the line number or numbers that we just previously created and saved.

Option 2: Adding a division

The procedure to add a division is similar to adding a bus line or set of lines. Go to the preceding section on adding a line and repeat the following steps.

Steps 1 to 3.

Repeat as for section 4.3, adding a bus line.

Step 4

Move the cursor in Figure II-7.7 to the DIVISION menu item and press Return.

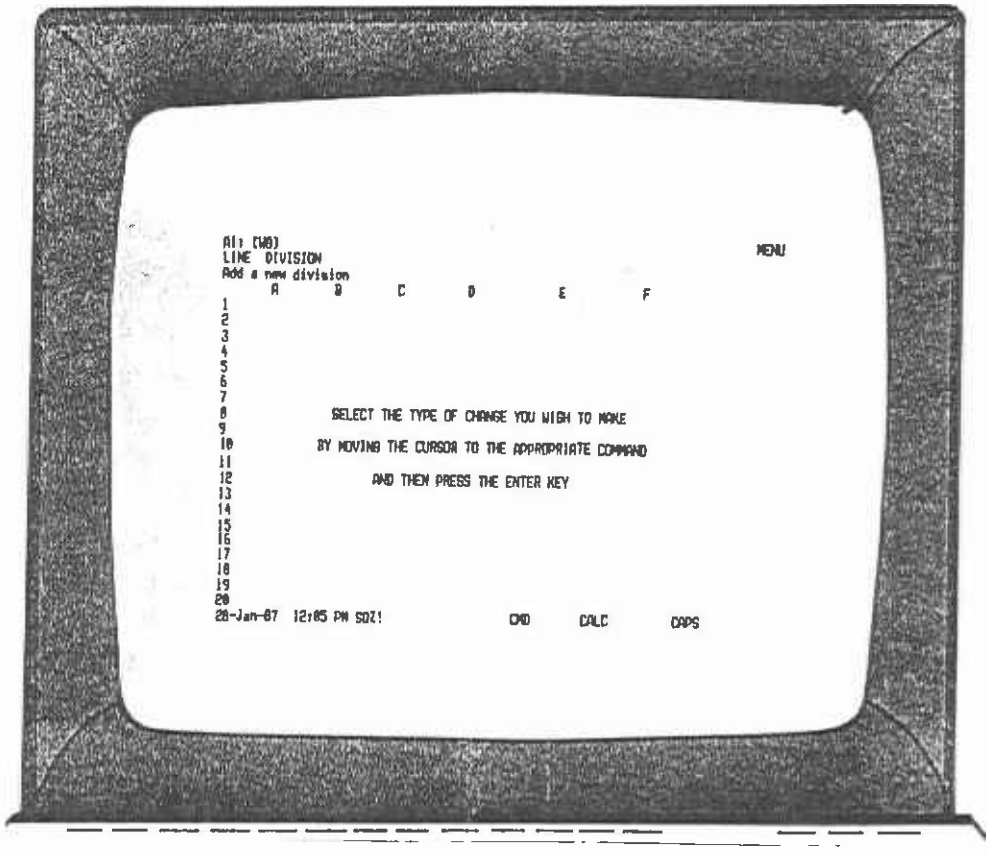


FIGURE II-7.7

Step 5.

The next screen (Figure II-7.8) is the data entry screen. It is identical to the data entry screen for adding bus lines. However, the program will check to see that the division number you enter does not already exist and that it is less than 21. You can create a new set of bus lines for a new division using this option. Even though the program does not check to make sure the new lines are between 800 and 850, the user must confine himself to this set of numbers. Be sure to enter the day of the week in upper case letters (WEEK SAT SUN).

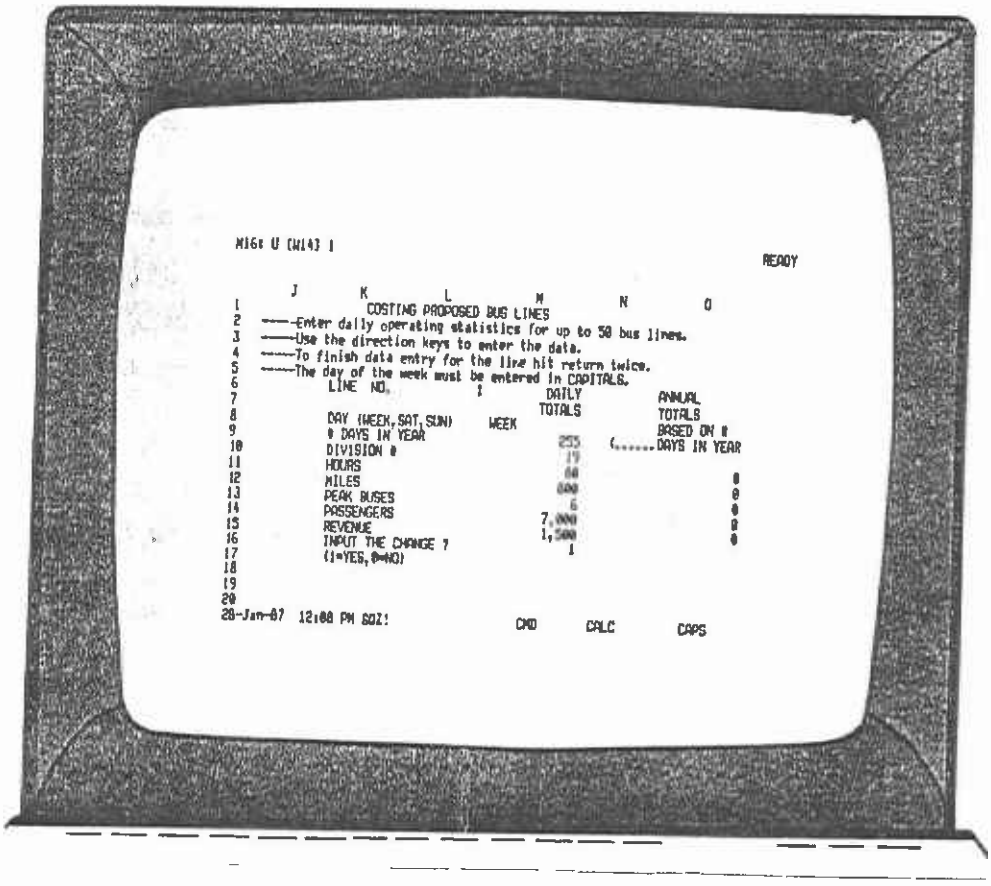


FIGURE II-7.8

Steps 6 and 7.

Same as in section 4.3, adding a bus line.

Option 3: Deleting a bus line or set of lines.

Steps 1 and 2.

These are the same as adding a bus line.

Step 3.

When the Primary file has been loaded, the menu screen will be displayed. In order to delete a line, move the cursor over to the delete item and press Return.

Step 4.

The next screen (Figure II-7.9) displays the top of the database. On the second top line is a prompt which checks to make sure that the user really wants to move into the delete mode.

Enter 1 and press Return to continue.

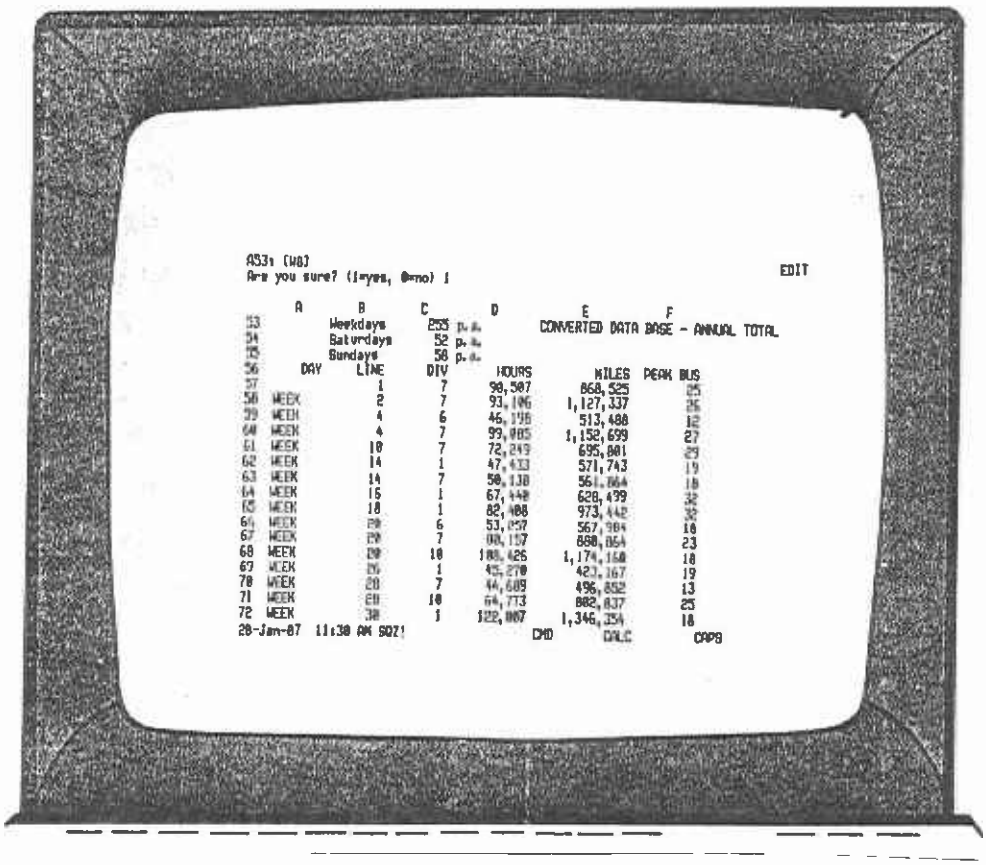


FIGURE II-7.9

Step 5. Enter line number to be deleted.

This step has two screens, both of which appear similar but which have different prompts at the top. The first screen (Figure II-7.10) asks which line the user wishes to delete. Enter the line number and press Return. The cursor then moves to the next input line and asks for the division in which the line is located. The prompt on the second top line now asks for the division number of the line. Enter the division number and press Return.

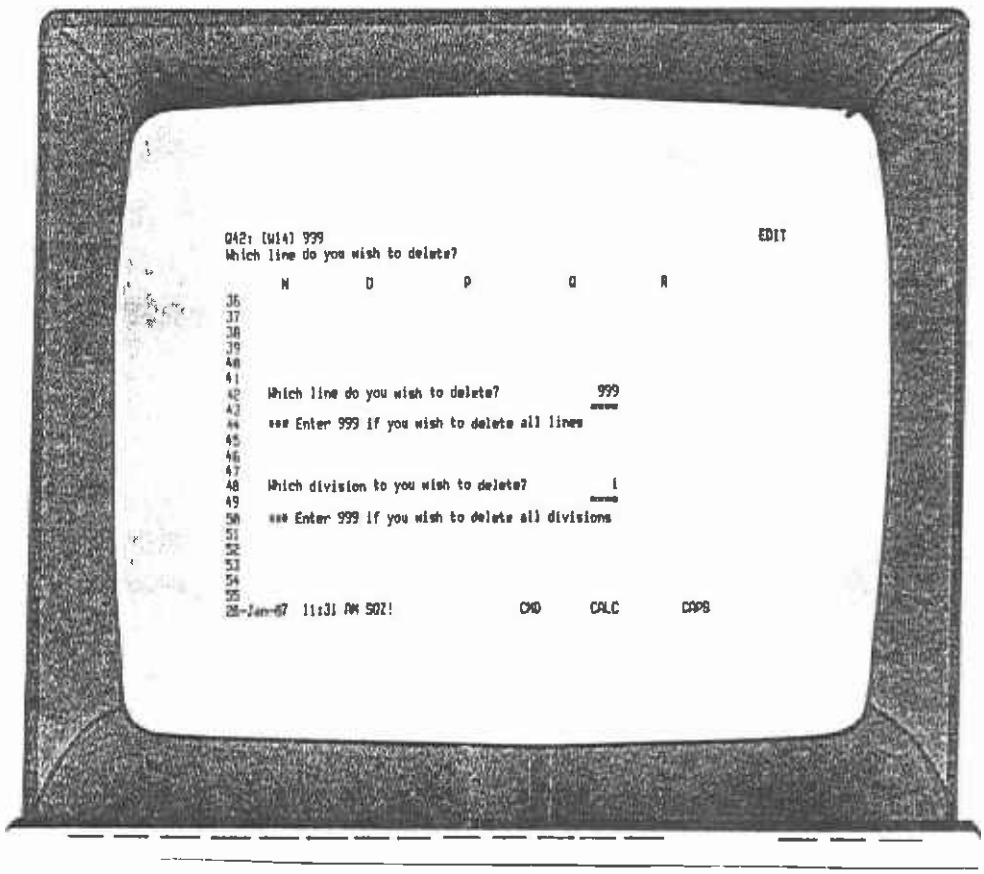


FIGURE II-7.10

Step 6. Delete another line or Exit

The next screen cycles back to the menu screen. Should you wish to continue deleting lines, simply repeat the process again.

After you have finished deleting lines, remember to select the "cost" menu item in order to save the changes you have made on the temporary file.

Option 4: Deleting a division

The procedure for deleting a division is similar to deleting a bus line or set of lines.

Steps 1 to 4.

Repeat as for deleting a bus line.

Step 5.

This screen (Figure II-7.11) is the same as the screen for deleting a bus line. Because we wish to delete a division, we will effectively be deleting all the bus lines operating out of that division. Hence, at the first prompt on this screen, enter the number 999 and press Return. At the next prompt, enter the number of the division you wish to delete and press Return.

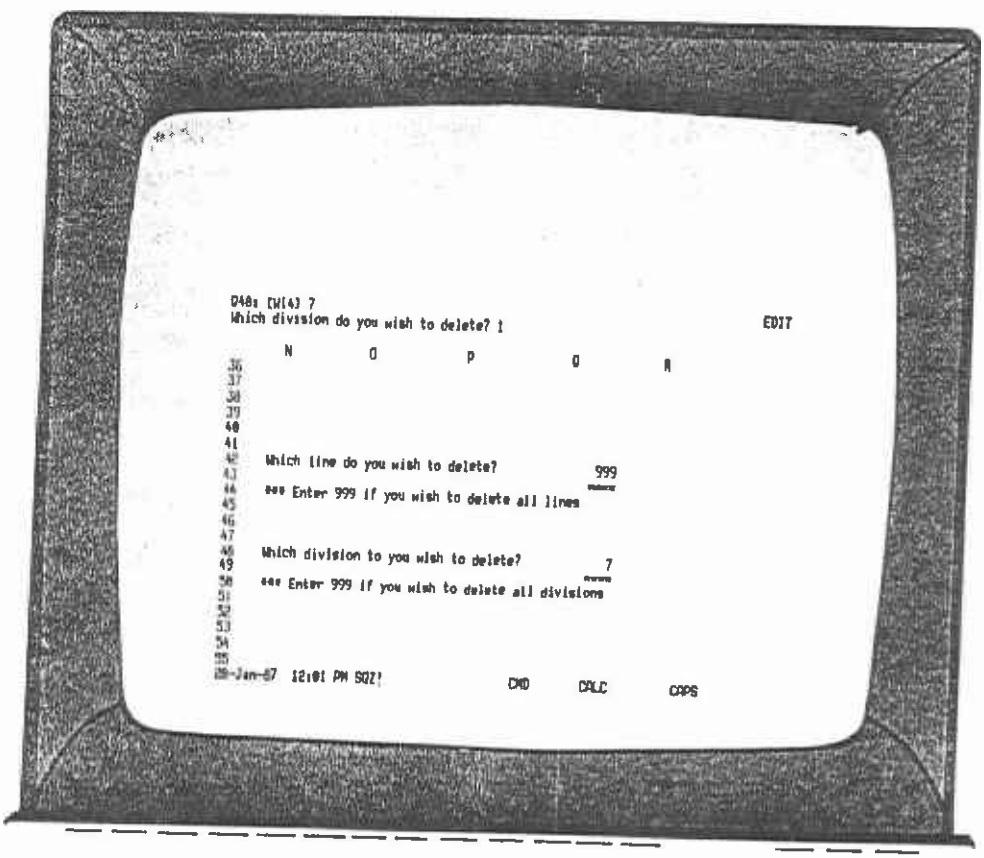


FIGURE II-7.11

Step 6.

Same as for deleting a bus line.

Option 5: Reallocating lines between divisions

Steps 1 and 2.

Repeat these steps as for adding a bus line. This will bring you to the first menu screen of the Primary file.

Step 3.

Select the reallocate function by moving the cursor to this menu item and press Return.

Step 4.

The next screen (Figure II-7.12) is a submenu which has two choices: reallocate all of one division to another or reallocate a line of one division to another. If, for example, the user wishes to reallocate a line of a division to another division moves the cursor to the LINE item and presses Return.

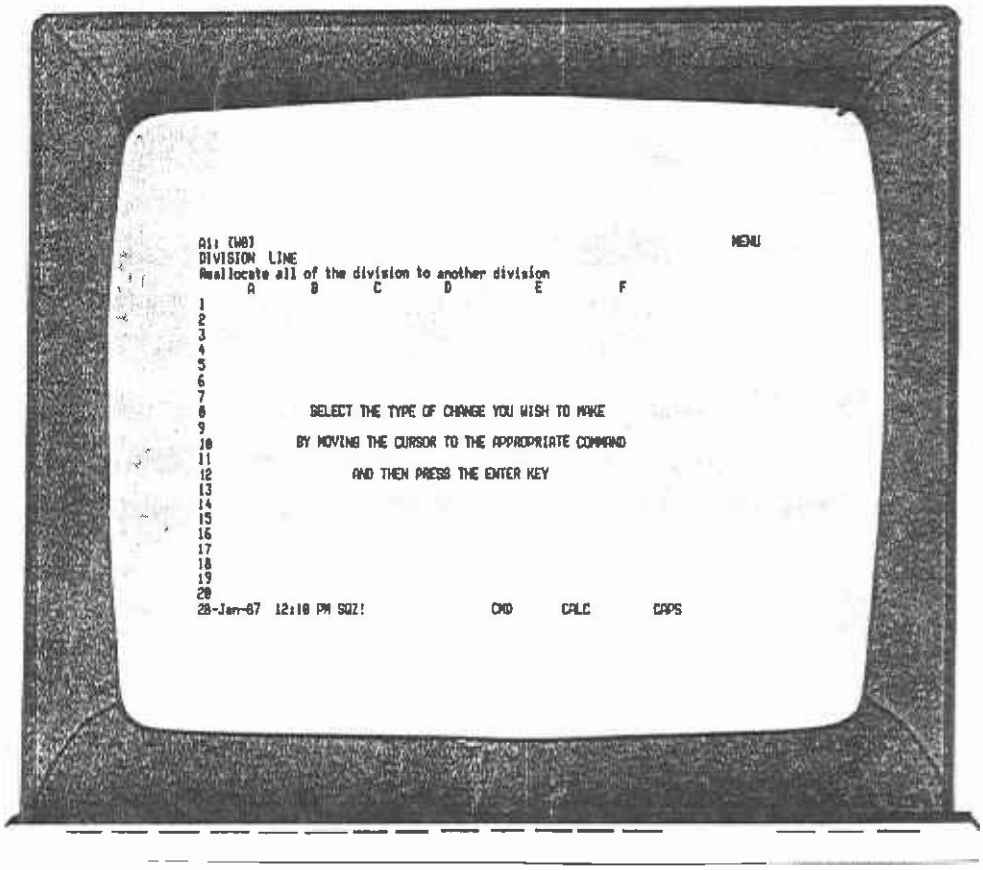


FIGURE II-7.12

Step 5.

The screen then changes to the first half of the database (Figure II-7.13). The prompt on the second line from the top asks the user to specify the line number he wishes to reallocate. Enter the line number and press Return.

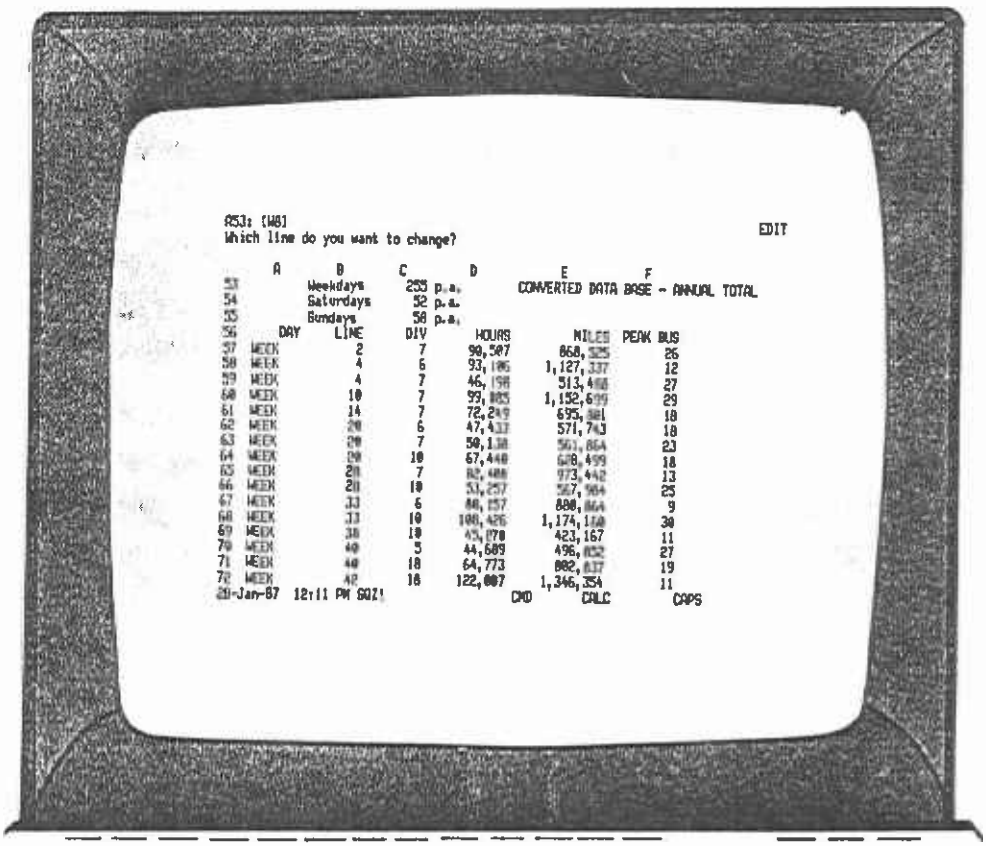


FIGURE II-7.13

The following screen (Figure II-7.14) asks for the division in which the line number is currently found. Enter the division number and press Return.

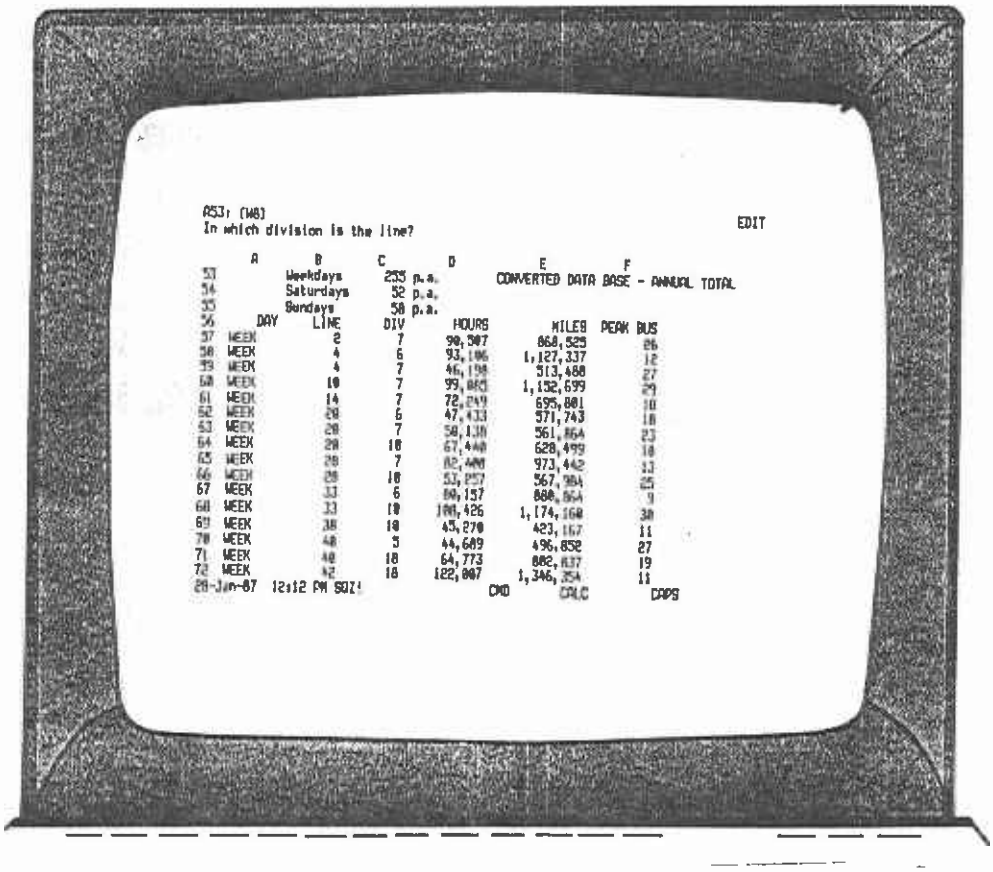


FIGURE II-7.14

The final prompt at this step asks to which division the line should be reallocated. Enter the new division number and press Return.

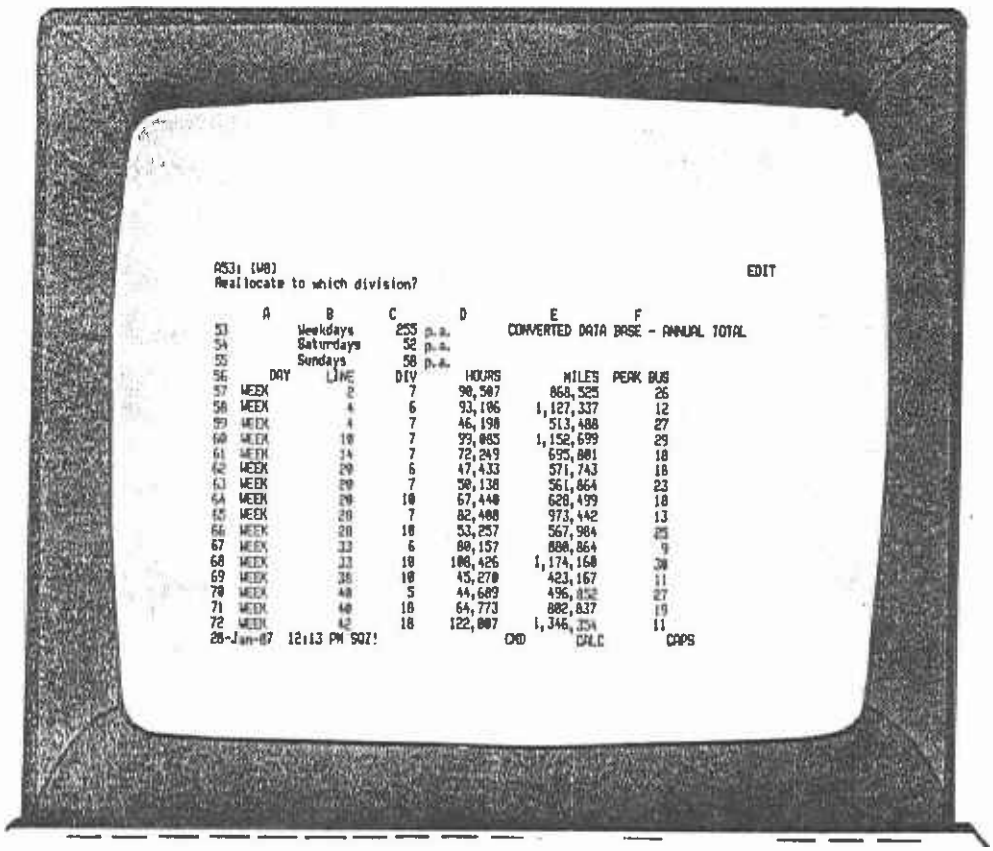


FIGURE II-7.15

Step 6.

This screen (Figure II-7.16) advises the user that the change will take some time. In fact, the change can take up to ten minutes, depending on the speed of the computer. At the bottom of the screen, the user can see the current line number that is being processed and thus get an idea of how far the reallocation process has progressed. The reallocation process is the most time-consuming function on the Primary menu, because it entails searching through the data base line by line.

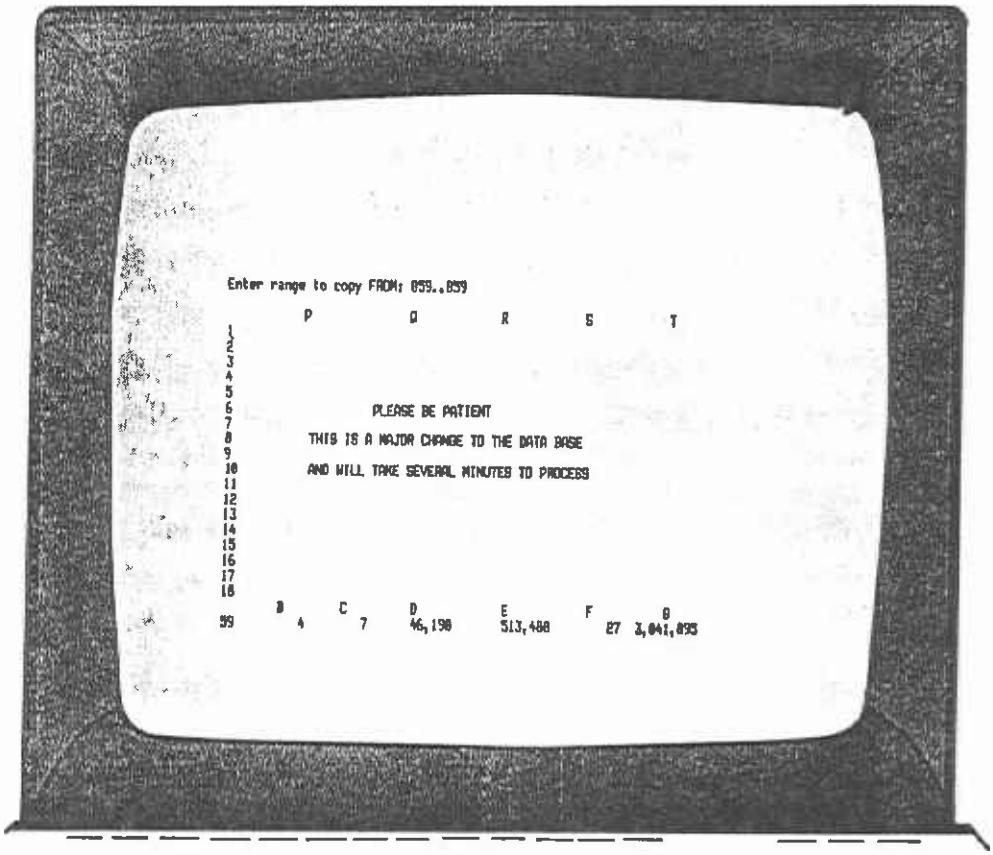


FIGURE II-7.16

Option 6: Reallocating divisions

The process is similar to reallocating a line between divisions.

Steps 1 to 3.

Repeat as for reallocating a line between divisions.

Step 4.

Select the DIV menu item in order to shut down a division and reallocate all of the lines.

Steps 5 and 6.

Similar to reallocating a line, except now the user will be specifying which division he wishes to shut down and the division to which the bus lines should be transferred.

8. HOW TO READ AND USE THE SPREADSHEET OUTPUT

In the process of calculating the costs of operation in Module 1, the user has the option to print out various parts of the spreadsheet.This module is the only module which provides a printout option. This chapter describes and explains the contents of the various printouts. It follows the order in which the program offers the option to print the results of the calculations.

Each printout has a banner identifying the month and year in which the current database in use was created. This also corresponds to the date of creation of the bus line schedule file from which the database was developed. The current date and time are also provided on each printout to help with later identification.

8.1 PRINTOUT 1: SUMMARY OF ANNUAL LINE DATA

The first printout (Figure II-8.1) provides a copy of the annual level-of-service data for the bus lines nominated for costing. In this example, bus line number 30 was specified for all days of the week. The printout shows the annual revenue bus hours, miles, passengers, and cash box revenue for the weekday services, Saturdays, and Sundays. The peak buses are not annualized. They represent the scheduled number of buses operating on a weekday afternoon between 3 p.m. and 6 p.m.

Module 2 provides users with the option of changing the number of weekdays, Saturdays, or Sundays in a year. This flexibility is important because new holidays or special events may change a weekday service into a Saturday or Sunday. Thus, the number of weekdays could be reduced from 255 to 254 or, of course, there may be an increase if some Sundays are treated as Saturdays or weekdays. The annual figures in the database are actually calculated from daily level-of-service data. The original bus line data that were used to create the database were all in daily totals for bus hours, miles, passengers, and revenue. The annual figures are calculated based on the current conversion rates specified in Module 2. These current rates are presented at the head of the database, and the user should check these to make sure that they are appropriate for the exercise in hand.

8.2 PRINTOUT 2: DIVISION COST SUMMARIES

The second printout (Figure II-8.2) is a summary of the partial cost of operating the bus lines specified. The cost is given by division because the spreadsheet is designed to allocate costs between individual divisions and those costs that are shared by all divisions. In this case, only bus line 30 was specified, and it is operated only out of Division 1. Hence, there is only one division summary printout. However, if more bus lines were specified which operated out of other divisions, then each division would have a similar printout. The line numbers in each division are provided at the top of the

printout just below the division number and time.

The costs of operating the bus line (or lines) are given in the middle of the spreadsheet. The total cost ($4,931,072) consists of cost elements that can be allocated back to the level-of-service variables PM peak buses, hours, and miles of operation. The cost is the incremental cost of operating the bus lines out of the division. Remember that this is a partial cost, because the cost of the system or pooled effect is not yet added nor the costs allocated to other possible divisions. In this example, the marginal cost is in parentheses, indicating that it is negative; that is, revenue exceeds the costs to date.

8.3 PRINTOUT 3: ALLOCATION OF ANNUAL COSTS FOR A DIVISION

This printout is actually a copy of the division cost spreadsheet that calculates the operating costs for divisions. The spreadsheet has three major parts:

1) Allocation of costs to PM peak buses,
2) Allocation of costs to bus hours, and
3) Allocation of costs to bus miles.

Each line of the spreadsheet calculates the cost of a budget line item or a group of budget line items. The set of budget line items in the first part of the spreadsheet has been allocated to PM peak buses. This means that these budget items are related to the number of peak buses supplied in a division. In the second part of the spreadsheet each budget line item is related to the bus hours level-of-service measure, and in the third part of the spreadsheet they are related to bus miles.

There are three sorts of relationships; direct, stepwise, and fixed. Direct relationships occur when costs vary proportionately to changes in a level-of-service measure. Stepwise relationships, on the other hand, vary in discrete jumps once thresholds have been exeeded by level-of-service variables. Fixed relationships are constants and do not vary with level-of-service measures. In the division spreadsheet, all the budget line items are stepwise variables. An explanation of each of the columns in the spreadsheet will explain how the stepwise relationship is calculated.

The first column in Figure II-8.3 refers to type of variable. Each line is a stepwise division-based variable (hence Step D, the D for division). The second column is the fiscal year cost for the line item. The third column FY 1986 BASE is the total level-of-service measure for the system. In the first part of the spreadsheet, 1987 refers to the number of buses in the whole bus system. In the second section (column 3), the 107165000 is the total bus miles run for all the buses in the system. The fourth column, step size, is the increment in the level of service necessary to incur a cost increase (or decrease). Where costs are direct, the step size is one, meaning that costs will be a continuous function of the level-of-service. The step size is calculated by dividing the annual level-of-service measures for the whole system by the number of employees in the corresponding line item.

The number of steps (column 5) generated is calculated by dividing the total level-of-service measure (say peak buses or annual vehicle hours) by the step size. The sixth column is the step cost. This is determined by dividing the FY 1986 cost by the FY 1986 BASE. The seventh column, Annual Cost, is the product of the step cost by the number of steps.

To interpret the output, the division costs for bus line 30 can be examined briefly. First, at the top of the spreadsheet, the annual level-of-service data for all the buses specified that run out of division 1 are given. In this case, since only one line is specified, it is the level-of-service data for bus line 30. If more than one bus line was specified, then the total level-of-service measures for those lines operating out of division 1 would be given here. These are then copied to their corresponding sections for the cost calculations. The first budget line in the first section of the spreadsheet (PM peak buses) refers to servicing mechanics in the maintenance operating division of Division 1. In 1986, service mechanics cost about $10.9 million. The step size is 6. This means that there needs to be a cut of at least 6 peak buses before one service mechanic can be saved. A service mechanic cost $31,945 in 1986. Since there are, in fact, forty-five peak buses on line 30, cutting all of these would save seven service mechanics (forty-five peak buses/step size of 6), for a total savings of $223,615 (7*$31,945). Each budget line cost item is calculated in the same way, and the total cost of operation for each level-of- service measure is given in the last row of each section. These totals are then summarized at the bottom of the spreadsheet in the "divisional cost summary."

8.4 PRINTOUT 4: COST DETAILS

The fourth printout (Figure II-8.4) is a summary of all the division costs plus the pooled or systemwide costs. In this example, since bus line 30 operates out of Division 1, only the costs for Division 1 are given. After the costs of each division are given, the system costs are presented. These are presented in two forms:

System-Full
System+Full

The first, system-full, is the pooled costs (systemwide costs) without the fixed costs or overheads being included. The second, system-full, includes the fixed costs. The marginal cost, $1.586 million, is the incremental cost of running the bus line annually. It includes the division and pooled systemwide costs but does not include the overheads or fixed costs. The full-cost line at the bottom is the total cost of running the bus line and includes the bus line's share of the fixed costs.

8.5 PRINTOUT 5: DATABASE SUMMARY BY DIVISION

This printout (Figure II-8.5) provides a summary of the level-of-service measures for each division. Each bus line operates out of one

or more divisions. The level of service of each bus line is allocated and summed to the division(s) from which it operates. The last line of the printout is the total level-of-service measures for all the bus lines. This total is used to calculate the systemwide costs in the next printout.

8.6 PRINTOUT 6: ANNUAL OPERATING COSTS FOR ALL DIVISIONS

This printout (Figure II-8.6) is a copy of the systemwide spreadsheet. Recall that the model calculates the cost of operating buses by allocating the costs back to individual divisions, where possible. However, there are some costs which cannot easily be allocated back to a single division, because they are shared by all divisions. These are joint costs and the systemwide spreadsheet estimates these shared or pooled costs. For example, planning, administration, central stores, central maintenance, and transit police are some functions that are shared by all divisions. Each line of the systemwide spreadsheet calculates the cost of these items. They are calculated in an identical manner to those costs in the division spreadsheet. There are, however, a few differences between the spreadsheets.

The systemwide spreadsheet has four major parts. The first three are identical to the division spreadsheet, but the fourth contains those budget line items that vary with changes in the annual number of passengers, such as timetables and ticket clerks. Another difference is the type of variable (column 1). Most of the variables are stepwise, but notice that the first budget line item in the first part (PM peak buses) is a direct variable. There are also two more direct variables in the third part of the spreadsheet. In the case of the first direct variable, this means that radio supplies vary directly with the number of buses. Each bus needs a radio, so the step size in column 5 is 1. Where variables are stepwise, the step size is greater than 1, reflecting the nature of the threshold effects of these variables.

The systemwide spreadsheet also contains the fixed costs. The fixed costs have been allocated to peak buses, annual bus hours, and annual passengers. The calculation of these costs is straightforward. The cost is estimated as a proportion of the level of service of the bus line to the total level of service for the system. For example, bus line 30 has about 2% of the PM peak buses for the whole system (45/1987). Its share of the total fixed costs for this level-of-service measure is also 2%(45/1987*86714000).

8.7 PRINTOUT 7: FINAL SUMMARY SCREEN

The last printout (Figure II-8.7) is a copy of the summary screen. The first line of the table contains the total of level of service that the bus line(s) operates. The next line beneath the level-of-service measures divides the costs between the divisions and the system. The division costs are the sum of all of the division costs. The systemwide costs are presented with both fully allocated and not fully allocated costs. Each of these costs is broken down by the costs attached to the level-of-service variables. The last two lines present the marginal

and full costs for the bus line(s). The two figures at the bottom of the table under the total cost column represent the marginal cost (the top figure) and the full, or total, cost (the bottom figure). The marginal cost does not include the fixed costs. In the economic sense, it represents the cost of running the extra lines and is an incremental cost.

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

EXTRACTED ANNUAL LINE DATA FOR COSTING Time: 02:13 PM

Annual conversion based on: 256 WEEKDAYS
51 SATURDAYS
58 SUNDAYS

DAY	LINE	DIV	HOURS	MILES	PEAK BUS	PASS	TOTREV
WEEK	30	1	129,459	1,402,675	41	12,425,728	4,691,968
SAT	30	1	22,052	224,941	0	2,201,415	619,905
SUN	30	1	20,520	221,734	0	1,668,370	687,764

Figure II- 8.1

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

Summaries for division.) 1 Time: 02:14 PM
LINE NUMBERS 30

ALLOCATED COSTS FOR THE DIVISION

PM PEAK BUSES	HOURS	MILES	TOTAL COST	REVENUE
$295,566	$4,233,864	$401,860	$4,931,290	$5,999,637

MARGINAL COST=TOTAL COST-REVENUE ($1,068,347)

LEVEL OF SERVICE DATA FOR DIVISION 1

Division	peak buses	hours	miles	pass
1	41	172,032	1,849,350	16,295,513

FIGURE II- 8.2

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

ALLOCATION OF ANNUAL COSTS FOR A DIVISION Time: 02:14 PM

LEVEL OF SERVICE DATA FOR DIVISION 1

Level of Service	Division	peak buses	hours	miles	pass	rev
....>	1	41	172,032	1,849,350	16,295,513	5,999,637

DIVISIONAL COST ALLOCATION CALCULATIONS FOR DIVISION NUMBER 1

1. ALLOCATION OF COSTS TO PM PEAK BUSES FOR DIVISION

PM PEAK BUSES 41

Type	FY 1986 Cost $	FY 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
STEP D	10,944,000	1,987	6	7	31,945	223,615	Maint. Oper.Div.	Servicing Mechanics
STEP D	1,913,000	1,987	33	1	31,771	31,771	Maint. Oper. Div.	Servicing Deep Clean
STEP D	2,412,000	1,987	33	1	40,180	40,180	Maint. Oper. Div.	Wheelchair Maint. Mec.
STEP D	1,326,000	1,987	60	0	40,174	0	Maint. Oper. Div.	Farebox Maint. Mechan
STEP D	723,000	1,987	110	0	40,025	0	Maint. Oper. Div.	Special Projects Mech.
STEP D	9,742,000	1,987	153	0	750,139	0	Transp. Oper. Div.	All except Operators
STEP D	1,258,000	1,987	153	0	96,867	0	Purchasing	Division Storekeepers
STEP D	9,476,000	1,987	153	0	729,657	0	Maint. Oper. Div.	Misc.,Supp., Admin.,
Total	37,794,000					295,566		

2. ALLOCATION OF COSTS TO BUS HOURS FOR DIVISION

BUS HOURS 172,032

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
Step D	172,358,000	7,585,000	853	201	19,383	3,895,983	Transp. Oper. Div.	Operators
Step D	14,950,000	7,585,000	853	201	1,681	337,881	Non-Dept. Expenses	Workmen's Comp.--Oper
Total	187,308,000					4,233,864		

FIGURE II- 8.3

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

3. ALLOCATION OF COSTS TO BUS MILES FOR DIVISION

miles 1,849,350

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
Step D	24,152,000	107,465,000	178,810	10	40,186	401,860	Maint. Oper. Div.	Running Repair Mech.
Step D	2,009,000	107,465,000	2,149,300	0	40,180	0	Maint. Oper. Div.	Inspectors
Step D	241,000	107,465,000	17,910,833	0	40,167	0	Maint. Oper. Div.	Road Failure Mechanics
Total	26,402,000					401,860		

4. ALLOCATION OF COSTS TO PASSENGERS FOR DIVISION

Passengers 16,295,513

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $
	NO DIVISIONAL COSTS FOR PASSENGERS					
Total						

DIVISONAL COST SUMMARY

TOTAL COSTS

SOURCE	$ VALUE
1. Peak buses	295,566
2. Vehicle hours	4,233,864
3. Vehicle Miles	401,860
4. Passengers	0
Revenue	(5,999,637)
Total Marg Cost	(1,068,347)

FIGURE II- 8.3(CONT)

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

BUS COST ANALYSIS MODEL Time: 02:14 PM
GPC 1986

ANNUAL OPERATING COSTS FOR ALL DIVISIONS FROM LINES SPECIFIED

TOTAL PEAK BUSES,HOURS,MILES,PASSENGERS,REVENUE FOR ALL DIVISIONS

Totals:	peak buses	vehicle hours	vehicle miles	passengers	revenue $
	41	172,032	1,849,350	16,295,513	5,999,637

SYSTEM WIDE COST ALLOCATIONS

1. ALLOCATION OF COSTS TO PM PEAK BUSES FOR ALL DIVISIONS

PM PEAK BUSES 41

Type	FY 1986 Cost $	FY 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
Direct	150,000	1,987	1	41	75	3,075	Facilities Maint.	Supplies --Radio
Step S	2,690,000	1,987	32	1	42,645	42,645	Scheduling	Scheduling Checkers
Step S	1,688,000	1,987	47	0	39,928	0	Facilities Maint.	Electronic Maint. Mec.
Step S	544,000	1,987	117	0	32,032	0	Central Maint.	Service Workers
Step S	3,861,000	1,987	142	0	275,925	0	Facilities Maint.	Electrical, Prop
Step S	702,000	1,987	142	0	50,168	0	Maintenance Gen.	Maintenance Inst
Step S	573,000	1,987	153	0	44,121	0	Transp. Services	Radio Dispatcher
Step S	574,000	1,987	166	0	47,954	0	Central Maint.	Central Shop Superinte
Fixed	86,714,000	1,987	1	41	43,641	1,789,281		Fixed Cost Allocation
Total	97,496,000					1,835,001		

2. ALLOCATION OF COSTS TO BUS HOURS FOR ALL DIVISIONS

BUS HOURS 172,032

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
Step S	1,204,000	7,585,000	216,714	0	34,400	0	Maint. Oper. Div.	Non-Revenue Main
Step S	967,000	7,585,000	329,783	0	42,044	0	Scheduling	Schedule Makers
Step S	792,000	7,585,000	421,400	0	44,001	0	Transp. Services	Street Supervisor
Step S	586,000	7,585,000	446,176	0	34,471	0	Transit Police	Transp. Service
Step S	708,000	7,585,000	474,000	0	44,244	0	Transp. Instruct.	Operator training
Step S	373,000	7,585,000	632,083	0	31,083	0	Account. & Fiscal	Payroll Clerks
Fixed	3,869,000	7,855,000	1	172,032	0	84,296		Fixed Cost Allocation
Total	8,499,000					84,296		

FIGURE II- 8.4

3. ALLOCATION OF COSTS TO BUS MILES FOR ALL DIVISIONS

BUS MILES 1,849,350

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $	Department	Item
Direct	25,421,000	107,465,000	1	1,849,349	0.24	437,556	Maint. Oper. Div.	Parts, lubricant
Direct	29,047,000	107,465,000	1	1,849,349	0.27	499,879	Non-Dept. Expenses	Fuel and Taxes
Step S	5,750,000	107,465,000	69,332	26	3,710	96,460	Non-Dept. Expenses	Workmen's Comp.
Step S	3,055,000	107,465,000	107,465	17	3,055	51,935	Non-Dept. Expenses	Expen. and Prov.
Step S	1,567,000	107,465,000	2,755,513	0	40,179	0	Central Maint.	Running Repairs
Step S	1,487,000	107,465,000	2,904,459	0	40,189	0	Central Maint.	Mechanical Maint.
Step S	1,367,000	107,465,000	3,160,735	0	40,206	0	Central Maint.	Electrical Maint.
Step S	1,286,000	107,465,000	3,358,281	0	40,187	0	Central Maint.	Body Shop Mech.
Step S	1,206,000	107,465,000	3,582,167	0	40,200	0	Central Maint.	Transmission Mec.
Step S	1,085,000	107,465,000	3,960,185	0	39,983	0	Central Maint.	Engine Line Mech.
Step S	965,000	107,465,000	4,477,708	0	40,208	0	Central Maint.	Welding Mech.
Step S	763,000	107,465,000	5,656,053	0	40,158	0	Central Maint.	Cylinder Head Mech.
Step S	763,000	107,465,000	5,656,053	0	40,158	0	Central Maint.	Paint Shop Worker
Step S	563,000	107,465,000	7,676,071	0	40,214	0	Central Maint.	Machine Shop Mech.
Step S	563,000	107,465,000	7,676,071	0	40,214	0	Central Maint.	Sheet Metal Shop
Step S	523,000	107,465,000	8,266,538	0	40,213	0	Central Maint.	Frame Shop Mech.
Step S	523,000	107,465,000	8,266,538	0	40,213	0	Central Maint.	Upholstery Worker
Step S	442,000	107,465,000	9,769,545	0	40,182	0	Central Maint.	Systems Shop Mech.
Step S	321,000	107,465,000	13,433,125	0	40,125	0	Central Maint.	Engine Parts Cri
Step S	321,000	107,465,000	13,433,125	0	40,125	0	Central Maint.	Engine Teardown
Step S	201,000	107,465,000	21,493,000	0	40,200	0	Central Maint.	Sign Shop Mech.
Step S	161,000	107,465,000	26,866,250	0	40,250	0	Central Maint.	Tool & Unit Room
Total	77,380,000					1,085,830		

4. ALLOCATION OF COSTS TO PASSENGERS FOR ALL DIVISIONS

Passenger 16,295,513

Type	Fy 1986 Cost $	Fy 1986 Base	Step Size	No. of Steps	Step Cost $	Annual Cost $		
Direct	476,000	424,400,000	1	16,295,513	0	17,925	Print Shop	Timetables
Step S	1,362,000	424,400,000	163,231	99	524	51,876	Non-Dept. Expenses	Expenses for PL
Step S	37,650,000	424,400,000	163,231	99	14,481	1,433,619	Non-Dept. Expenses	Provisions for U
Step S	2,671,000	424,400,000	4,715,555	3	29,678	89,034	Customer Relations	Telephone Clerks
Step S	1,172,000	424,400,000	12,482,353	1	34,471	34,471	Transit Police	Police--Passenger
Step S	1,065,000	424,400,000	12,860,606	1	32,273	32,273	Account. & Fiscal	Cash Clerks
Step S	681,000	424,400,000	19,290,909	0	30,955	0	Marketing and Comm.	Ticket Clerks
Fixed	4,218,000	424,400,000	1	16,295,513	0	162,955		Fixed Cost Allocation
Total	49,295,000					1,822,153		

TOTAL SYSTEM COSTS SOURCE	FULL ALLOC $ VALUE	NON FULLY ALLOC $VAL
Peak buses	1,835,001	45,720
Vehicle hours	84,296	0
Vehicle Miles	1,085,830	1,085,830
Passengers	1,822,153	1,659,198
TOTAL MARG COST	4,827,280	2,790,748

FIGURE II- 8.4(CONT)

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

DATA BASE SUMMARY BY DIVISIONS Time: 02:14 PM

Level of Service	Div	Peak Buses	Hours	Miles	Passengers	Revenue
....>	1	41	172,032	1,849,350	16,295,513	5,999,637
TOTALS		41	172,032	1,849,350	16,295,513	5,999,637

FIGURE II- 8.5

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

COST DETAILS - SUMMARY BY DIVISIONS FOR THE SELECTED LINES Time: 02:14 PM

Division	Peak Buses	Hours	Miles	Passengers	Revenue $	Marg. Cost $
	(- - - - - - - - - COSTS $ - - - - - - - - - -)					
1	295,566	4,233,864	401,860	0	5,999,637	(1,068,347)
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
						0
SYSTEM-FULL	45,720	0	1,085,830	1,659,198		2,790,748
MARGINALCOST	341,286	4,233,864	1,487,690	1,659,198	5,999,637	1,722,401
SYSTEM+FULL	1,835,001	84,296	1,085,830	1,822,153	5,999,637	4,827,280
FULL COST	2,130,567	4,318,160	1,487,690	1,822,153	5,999,637	3,758,933

Note: Partial Cost includes no fixed overhead costs
Full Cost includes fixed overheads

FIGURE II- 8.6

GPC BUS COST MODEL V1. NOV 86 DATABASE 30-Jun-87

FINAL SUMMARY SCREEN Time: 02:14 PM

ANNUAL ALLOCATED BUS OPERATING COSTS

LEVEL OF SERVICE	PM Peak Buses	Hours	Miles	Passengers	Revenue
	41	172,032	1,849,350	16,295,513	$5,999,637

	DIVISION COSTS	SYSTEMWIDE NOT FULL	SYSTEMWIDE FULL	TOTAL COSTS
PM PEAK BUSES	$295,566	$45,720	$1,835,001	:
HOURS	$4,233,864	$0	$84,296	:
MILES	$401,860	$1,085,830	$1,085,830	:
PASSENGERS	$0	$1,659,198	$1,822,153	:
COSTS	$4,931,290	$2,790,748	$4,827,280	:
REVENUE	$5,999,637			:
				:
..MARGINAL COSTS	($1,068,347)	$2,790,748		$1,722,401
..FULL COSTS	($1,068,347)		$4,827,280	$3,758,933

FIGURE II- 8.7