DRAFT

SCRTD
BUS COST
USER MANUAL

MARCH, 1988

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GENERAL PLANNING CONSULTANT:

DRAFT BUS COST MODEL MANUAL

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PREFACE

This manual describes the operation of a revised version of the
earlier bus cost model program package, consisting of a LOTUS 123
program on an MS-DOS compatible microcomputer and a FORTRAN
program on the mainframe computer. The FORTRAN program is
discussed in the Appendix to this document.

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 3.

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 of 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.

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

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THE LOTUS PROGRAM

1. INTRODUCTION

The bus cost model allows the user to calculate operating costs associated with increases or decreases in levels of serviceprovided by the RTD bus system. The various options available to define levels of service are accessed through a main menu which appears at the beginning of the program. That menu offers six options:

1. Cost lines or divisions,
2. Change the number of weekdays, saturdays, and sundays,
3. Add/delete/reallocate lines or divisions,
4. Copy in new dataset from the mainframe,
5. Create new permanent and temporary datasets,
6. Exit.

Chapter 4 of this manual descibes each of these options sequentially.

A flowchart of the bus cost model is shown in Figure 1. Like this manual, the flowchart is organized according to the six options in the main menu. The flowchart is included as a "road map" for the model. Bus Cost is a complex model. New users are encouraged to reference the flowchart as they progress through the users manual and learn their way around the model.

Each menu option procedure takes the user through a sequence of screens. Especially while in the learning phase, users may want to abort a procedure and return to the main menu. For that reason, many of the screens direct the user to input 999 to return to the main menu. If a particular screen does not include that instruction, continue on with the costing procedure until reaching a screen that includes this instruction.

This introductory chapter is followed by Chapter 2, Getting Started, and CHapter 3, A General Overview of the Model. Chapter 4, which discusses each of the main menu options, is followed by a chapter on the interpretation of output.

1
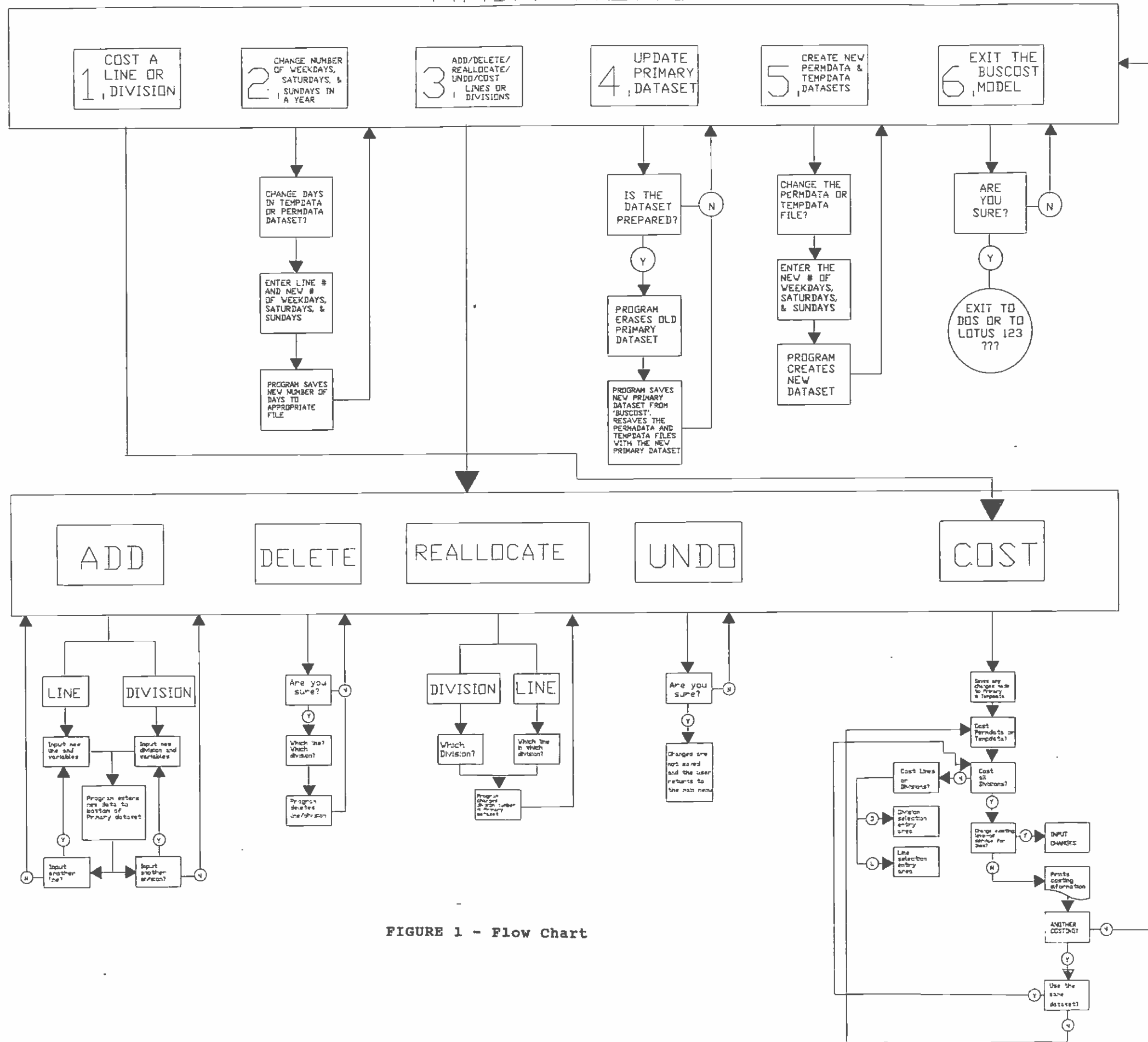
FIGURE 1 - Flow Chart

2. GETTING STARTED

All of the files needed to run the bus cost model are contained on one floppy diskette. That diskette is labeled "Bus Cost System Disk."

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 commuter. 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 file contains the "welcome" screen and the main menu.

Menu A small file that provides a place marker in the main menu.

Buscost5 The program that performs the cost calculations.

Buscost The original file containing the RTD system information from the mainframe computer. Used to create the working file called primary.

Primary This file contains the buscost-compatible version of the system information dataset downloaded from the RTD mainframe computer. This dataset is used as a template to create permdata and tempdata. Primary also contains a program which allows changes to lines or divisions.

Permdata A duplicate of the dataset contained in Primary that is used for the costing part of the program. Permdata can never be changed except when updating Primary from the RTD dataset.

Tempdata A duplicate of the dataset contained in Primary that is used for the costing part of the program.. The data in Tempdata can be changed and saved for future use.

Optmenu A small file to link the program files.

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Step 2: Copying your Bus Cost System Disk

Your Bus Cost system disk has a write-protect tab. Do not remove it. 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 an 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 will 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 2.1.

4
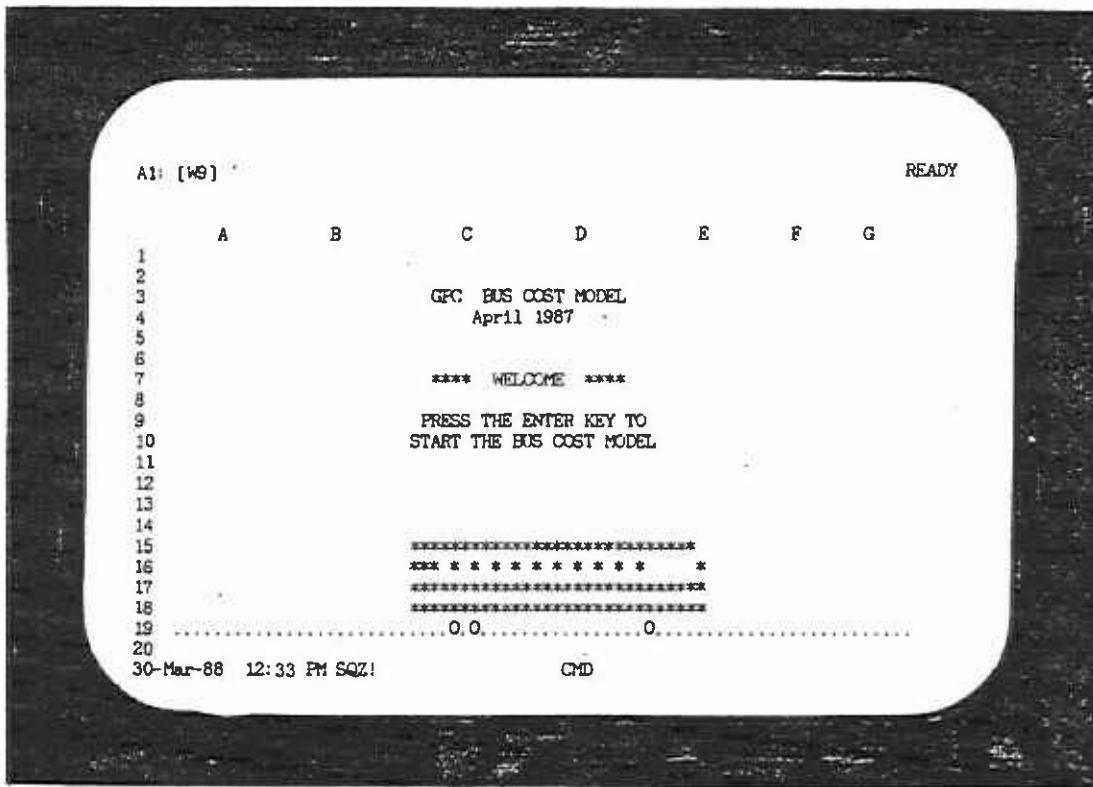
FIGURE 2.1
WELCOME SCREEN

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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 (see Figure 2.2). This is the menu that allows you to use the Bus Cost model.

Chapter 4 explains 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 3 briefly presents the methodology used to estimate bus costs.
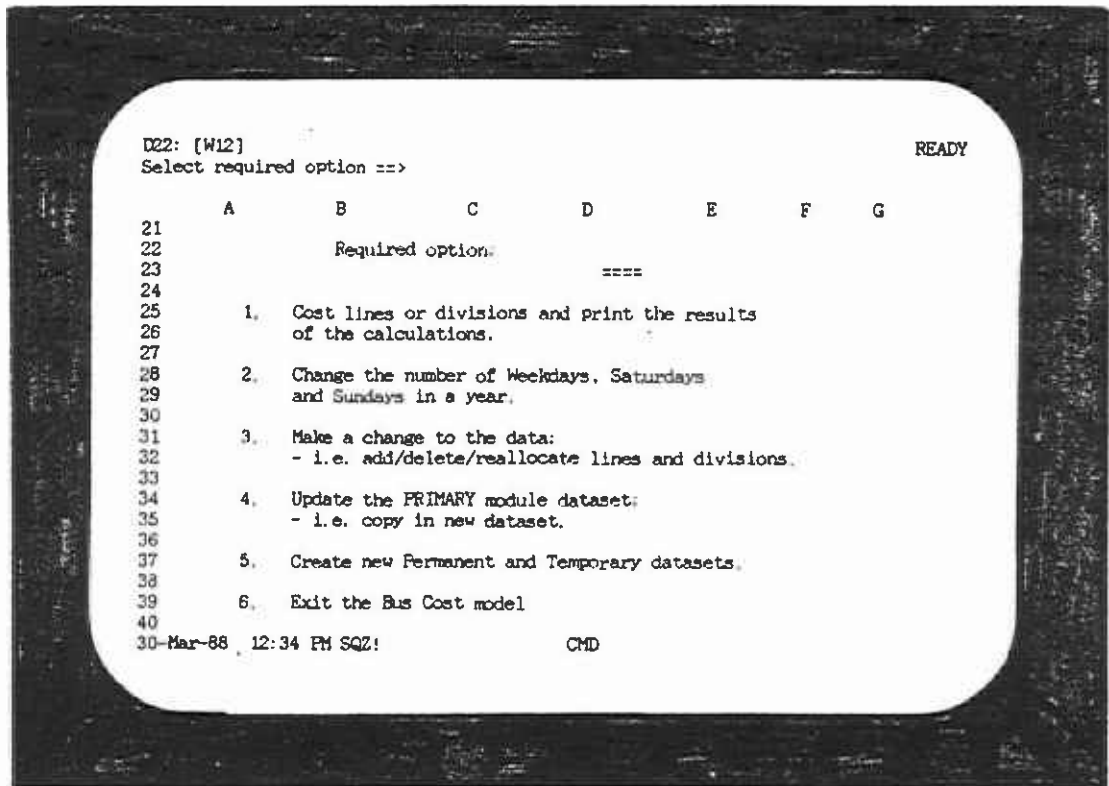
FIGURE 2.2
THE MAIN MENU SCREEN

From the main menu the user enters 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 in the upper 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 ready for the user to enter the correct option number.

3. OVERVIEW OF THE BUS COST MODEL

3.1 LEVEL OF SERVICE MEASURES

The bus 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.

3.2 FIXED AND VARIABLE COSTS

The bus cost model allocates both fixed and variable costs. The basis for the allocation is the RTD audited "blue book" annual budget. The cost of each blue book line item is allocated to one of the four level-of-service (LOS) measures defined above. Each budget line item is assigned to the LOS to which it is most sensitive.

Each line item is then defined as 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. Line items that vary in steps are generally those that are associated with labor positions. Step sizes are defined as the cost of one full-time or part-time position.

Figure 3 illustrates the allocation of budget line items to variable step and fixed costs.

Figure 3

Budget Line Items

Annual Vehicle Miles Service Hours Stepwise Variable Items	Average Weekday P.M. Peak Buses Variable Items	Annual Passenger Boardings 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.

3.3 DIVISION AND SYSTEM COSTS

The SCRTD bus system consists of a set of garages from which buses operate. Each garage constitutes a division, which substantially vary in size. Divisions perform daily maintenance routines on the buses (cleaning, fuel, simple servicing checks, etc.). Major overhauls are performed at a central maintenance facility. Planning, scheduling, and personnel functions are performed at a central administrative center.

Operations can be classified as activities that are performed within a single division and activities that are performed in centralized facilities, which service all the divisions. The cost model uses these classifications.

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, some costs associated with the central functions cannot easily be assigned 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 difficult to allocate these shared or joint costs logically at a more detailed level.

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The cost model allocates costs at two levels, first at the level of the individual division, and second at the level of the whole system which encompasses all divisions. Reflecting this dichotomy, there are two parallel spreadsheets, one for individual divisions and another for all divisions. The spreadsheet which allocates costs to all divisions is called the systemwide spreadsheet.

Similarly, each line has costs of operation which can be classified as costs that can be allocated to the division within which it operates (the Division cost) and costs that are joint or shared with all other lines as part of the system costs. The cost of running a bus line can therefore be catagorized as:

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

3.4 BUS COST FILES

The bus cost model consists of seven LOTUS 123 files. They are:

o   Auto123 - the main menu
o   Menu - a small helper file
o   Buscost5 - the costing program
o   Buscost - the RTD system information
o   Primary - the dataset "template"
o   Permdata - created from primary, changes cannot be saved
o   Tempdata - created from primary, changes can be saved
o   Optmenu - a small helper file

Three of these files (Primary, Permdata and Tempdata) are large files used to store the bus line datasets necessary to the cost calculations. Each file performs a different function which the user must understand to operate the model effectively.

The Primary file has two functions:

1) It contains a template of the original dataset downloaded from the RTD mainframe that has been converted for bus cost use by Option 4 of the main menu. This copy of the dataset is used to create the Permdata and Tempdata files. Primary is never changed except through Option 4 when updating data from the RTD mainframe files.

2) It contains a program that allows the user to update the system information through Option 4, change the number of weekdays, saturdays, and sundays in a year (used for annual calculations) through Option 2, and update the Permdata and Tempdata files through Option 5 of the main menu.

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Permdata is simply a copy of the dataset from the Primary file ready for use in the costing process. The Permdata file is changed only when an update of the Primary file is made from the RTD mainframe or when the user wishes to change the number of days in a year. Edits made to lines or divisions are never saved to the Permdata file.

Tempdata is originally an identical copy of the Primary dataset. The Tempdata file can be changed when an update is made to the Primary file or when the user wishes to change the number of days in a year. Additionally, if the user makes any changes to lines and/or divisions, the changes may be saved to the Tempdata file.

The system disk contains a clean version of the Tempdata file; that is, it is identical to the Primary and Permdata files. The user should be aware that as he runs the bus cost model and makes changes to the data and saves the changes to the Tempdata file, the Tempdata file is permanently changed. Please note that if your disk is loaned to another user, that user can make changes to your Tempdata file. If you want to start with a clean version of the Tempdata file, run option 5 to recreate the Tempdata file from the Primary file.

3.5 WHAT THE MODEL CAN AND CANNOT DO

This section lists briefly the model's capabilities and limitations.

The model can:

1. Create and cost up to fifty new lines.
2. Create up to four new bus divisions.
3. Save changes on a temporary file in any one run.
4. Cost one individual bus line or up to fifty individual bus lines in any one run.
5. Delete lines.
6. Reallocate lines to new divisions.
7. Shut down divisions.

3.6 THE STEP FUNCTION

The mechanics of the program consist of assigning fixed costs to bus lines according to "steps" related to levels of service. Cumulative increases or decreases in service trigger these steps when pre-set levels are reached. Because of the cumulative nature of the steps, different results are reached if a number of lines are costed individually or as a group.

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4. THE MAIN MENU

This chapter descibes the operation of the six options available in the main menu.

4.1 OPTION 1: COSTING LINES AND/OR DIVISIONS

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

Step 1--Select option.

Call up the main menu screen. The menu should look like Figure 4.1. Option 1 from the main menu performs the costing of lines and divisions.


```
I22: [W12] 1                                               READY
Select required option ==>

         A          B           C          D          E      F      G
21
22                 Required option:              1
23                                            ====
24
25        1.   Cost lines or divisions and print the results
26             of the calculations.
27
28        2.   Change the number of Weekdays, Saturdays
29             and Sundays in a year.
30
31        3.   Make a change to the data:
32             - i.e. add/delete/reallocate lines and divisions.
33
34        4.   Update the PRIMARY module dataset:
35             - i.e. copy in new dataset.
36
37        5.   Create new Permanent and Temporary datasets.
38
39        6.   Exit the Bus Cost model
40
30-Mar-88   12:35 PM SQZ!                      CMD
```

FIGURE 4.1
THE MAIN MENU SCREEN

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The user should be aware that when Option 1 is chosen, it is the same as choosing COST under Option 3. If the user chooses Option 1, the Tempdata file is not different from the Permdata file unless it was changed in a prior session. If the user chooses COST under Option 3 and has used the ADD, DELETE, or REALLOCATE commands first, the changes made will automatically be saved once the COST option is chosen. If the user has made changes under Option 3 and does not wish to save them, he must first use the UNDO command before going to the COST command.

Step 2--Select Use of Permanent or Temporary Files

The user must choose to work with either the permanent or temporary data files. If the user wants a "clean" dataset he may simply use the permanent file. If he created changes in a previous session or by using Option 3 in this session he can immediately access those changes by using the temporary dataset.

```
AF91:                                                    READY
Permanent or temporary dataset?

         Y        Z        AA       AB       AC       AD
81
82  **********************************************************
83                    GPC BUS COST MODEL
84                      JANUARY 1987
85  **********************************************************
86                    MODULE 1
87
88
89
90
91         Select dataset required  ===>
92                                    =====
93
94
95         1=PERMANENT DATASET
96         0=TEMPORARY DATASET
97         999=RETURN IMMEDIATELY TO MAIN MENU
98
99         Note: Typing 999 on most data entry screens will
100             get you back to the main menu.
30-Mar-88  12:38 PM SQZ!                CMD      CALC
```
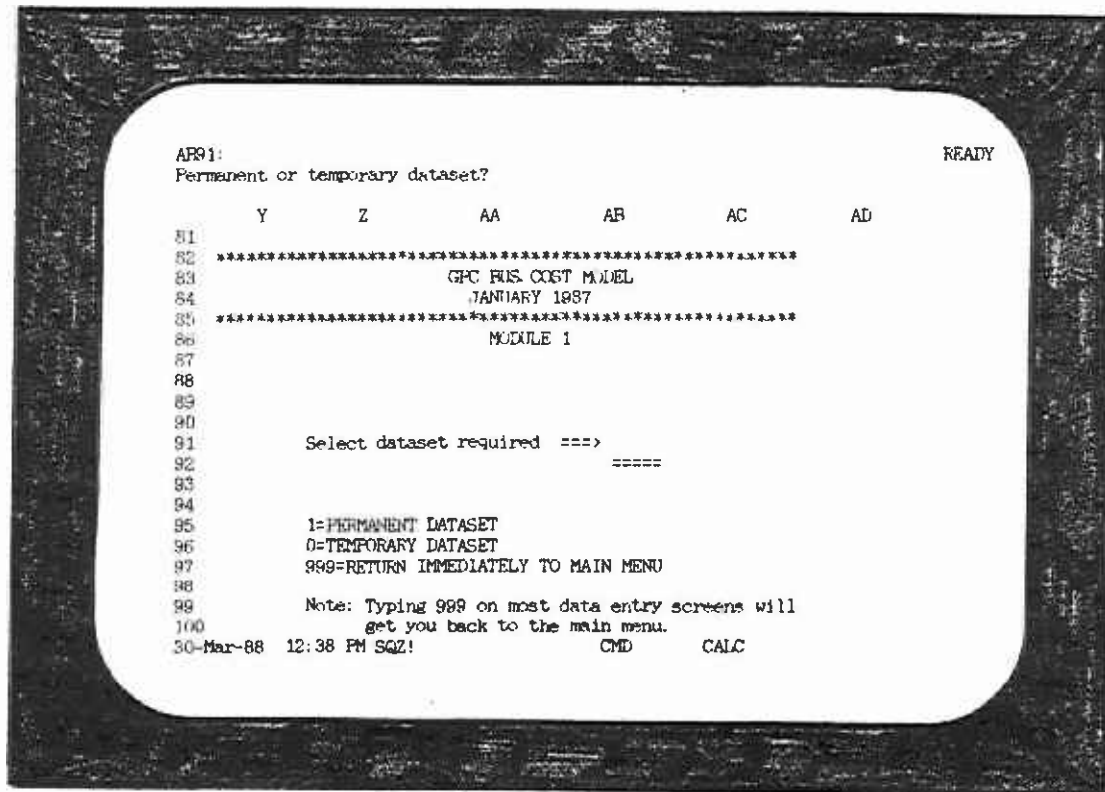
FIGURE 4.2

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Step 3--Selection of Lines or Divisions to be Costed

The next screen (Figure 4.3) allows the user to immediately cost all divisions. If 'Y' is entered, the program calculates the cost of running the entire bus system.

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

```
AC114!                                                                    READY
Enter Y all divisions N for no

         Y        Z         AA         AB         AC         AD
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.....>
115               999= EXIT TO MAIN MENU
116
117
118
119
120
30-Mar-88   12:40 PM SQZ!                    CMD      CALC
```
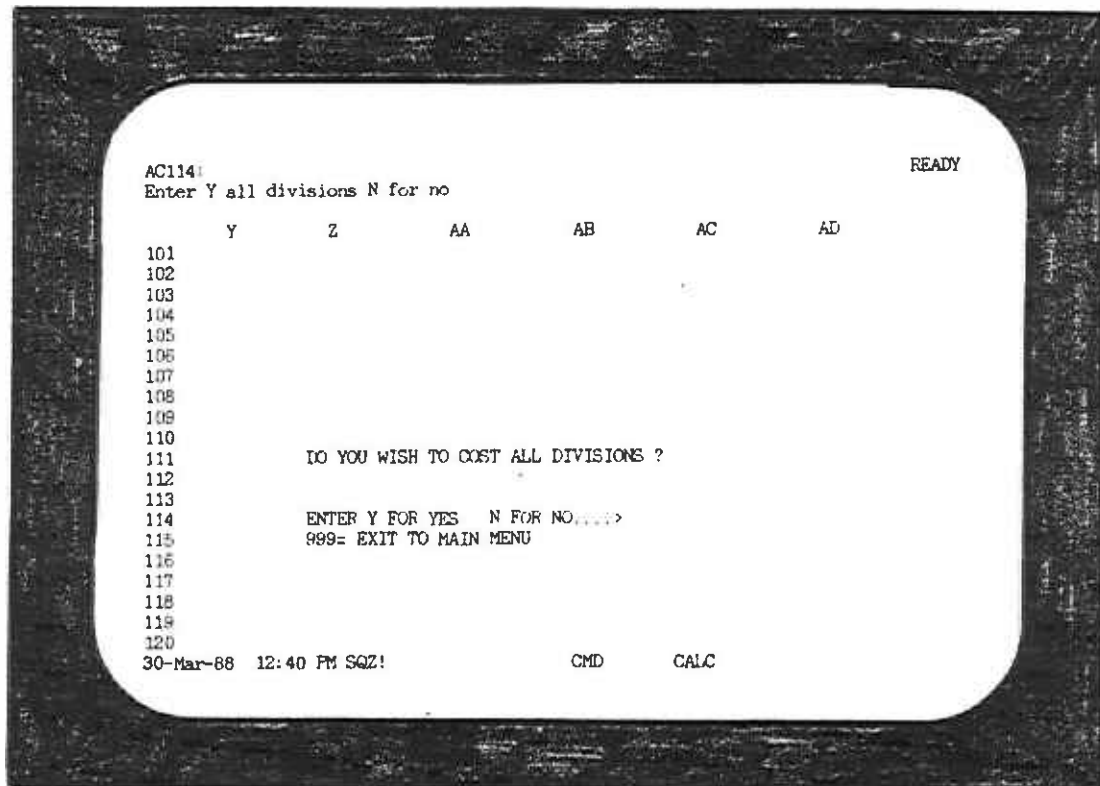
FIGURE 4.3

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Step 4--Costing by Line or Division

If the user entered 'N' in the previous step, the program now asks whether he wishes to cost a line or set of lines, or a division or set of divisions (see Figure 4.4). The entry procedures are similar in both cases.

To cost divisions, the program calculates the cost of operating all bus lines in the division specified.

To cost a single bus line, the letter L is entered. To cost a division, the letter D is entered.

```
AC74: U 'L                                                        READY
Enter L for lines, D for divisions

         Y         Z         AA        AB        AC        AD
61
62
63
64
65
66
67
68
69
70
71          Do you wish to cost lines or divisions?
72
73
74          ENTER COST LEVEL OPTION HERE.......> L
75
76          L=  COST BY LINE
77          D=  COST BY DIVISION
78          999=EXIT TO MAIN MENU
79
80
30-Mar-88  12:41 PM SQZ!                    CMD       CALC
```
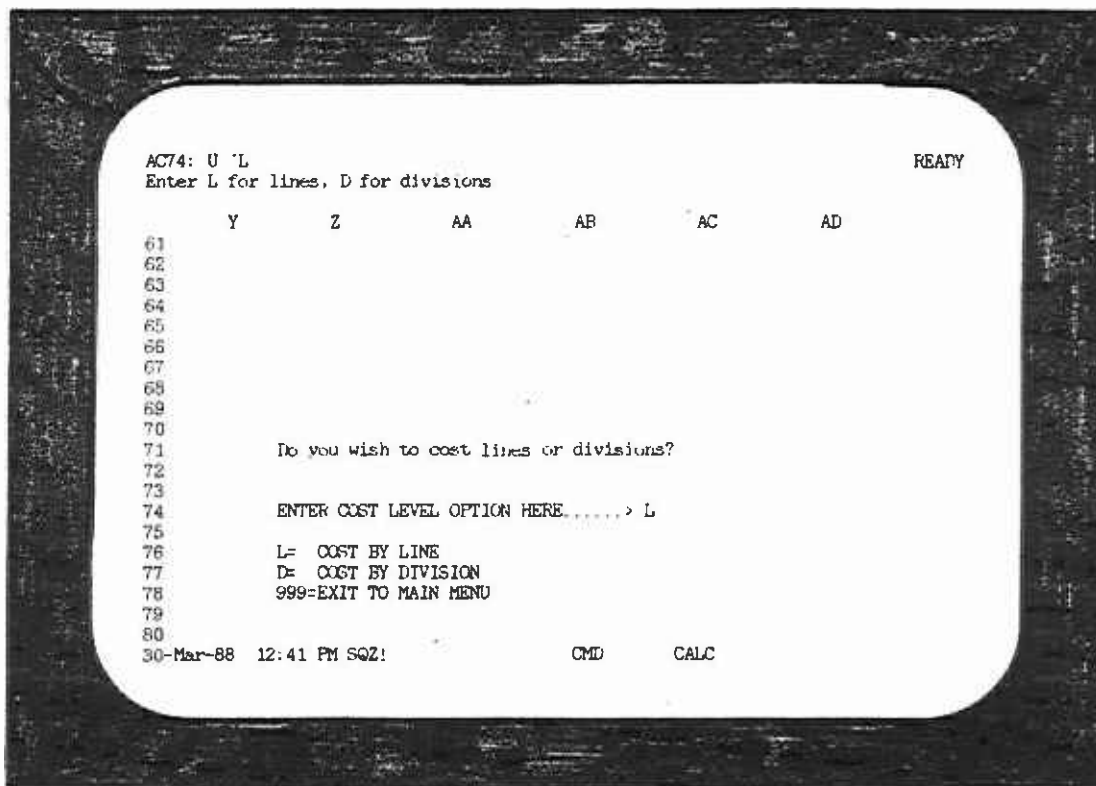
FIGURE 4.4

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Step 5--Select Line or Division Number

The next screen (Figure 4.5) requires the user to specify the line or division number and the day of the week that is required for costing. The user enters numbers under the LINE or DIV column. Use the right directional (cursor) key to move the cursor over to the DAY column. In the example, we chose to cost bus lines and bus line number 30 was selected. We entered the number 30 and then pressed the cursor 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 operate.

When all lines or divisions to be costed have been entered, press Return twice.

FIGURE 4.5

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After entering the line number and day of the week, the next screen (Figure 4.6) 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 multiple lines is being costed, this revision feature can help minimize mistakes and save considerable time.


```
AN75: U [W6] 30                                                      READY

        AN       AO                              AP
74    LINE DAY
75      30 *
76    ...     ...
77    ...     ...
78    ...     ...
79    ...     ...
80    ...     ...      YOU HAVE SELECTED THESE BUS LINES FOR COSTING.
81    ...     ...
82    ...     ...      TO MAKE CHANGES TO THE DATA USE THE DIRECTION KEYS
83    ...     ...      TO MOVE ABOUT THE DATA INPUT AREA AND REENTER ANY
84    ...     ...      LINE NUMBERS AND DAYS.
85    ...     ...
86    ...     ...      REMEMBER TO USE CAPITALS FOR THE DAYS.
87    ...     ...
88    ...     ...      WHEN YOU HAVE FINISHED PRESS ENTER TO BEGIN COSTING.
89    ...     ...
90    ...     ...
91    ...     ...
92    ...     ...
93    ...     ...
30-Mar-88  12:44 PM SQZ!              CMD        CALC
```

FIGURE 4.6

Step 6

This step involves no user input. The screen (Figure 4.7) simply advises the user that searching the dataset may take time. The more lines specified, the longer the search time. Please be patient.


```
Y160: [WS]                                                        WAIT

          Y         Z         AA        AB        AC        AD
160
161                                                1111
162                                               11111
163                                              111111
164                                             11111111
165                                            1111111111
166                                           11111111111
167                                          111111111111
168                                         1111111111111
169                                        11111111111111
170
171       PLEASE WAIT A WHILE . THE DATASET IS BEING ACCESSED
172
173                                        11111111111111
174                                         1111111111111
175                                          111111111111
176                                           11111111111
177                                            1111111111
178                                             11111111
179                                              111111
          SQZ!
```
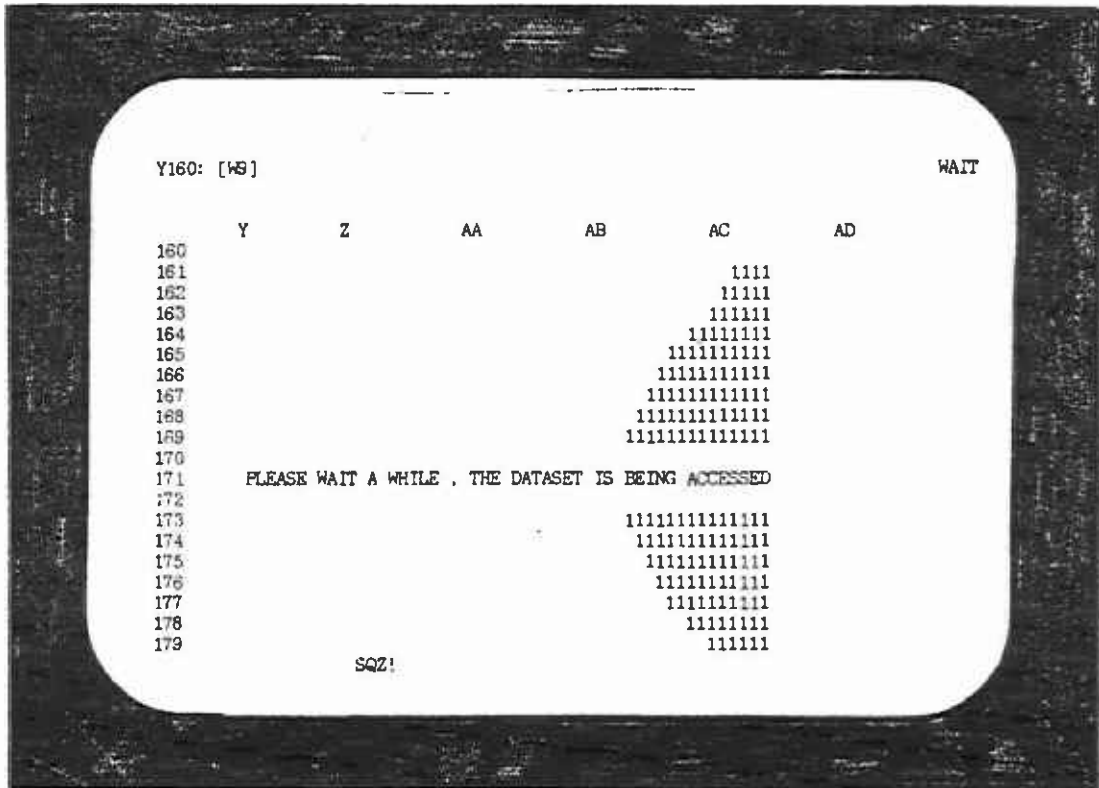
FIGURE 4.7

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Step 7--Changing Existing Levels of Service

At this point in the costing process, the current Bus Hours, Bus Miles, P.M. Peak Buses, Passengers, and Revenue for the lines specified have been retrieved from the dataset. The next screen (Figure 4.8) asks if the user desires to change the existing level-of-service data. Any change made applies only to the current calculation. Changes are not saved, and the permanent dataset is not altered. The prompt on the second line from the top asks the user to enter 'Y' if he wishes to change the data, or '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.
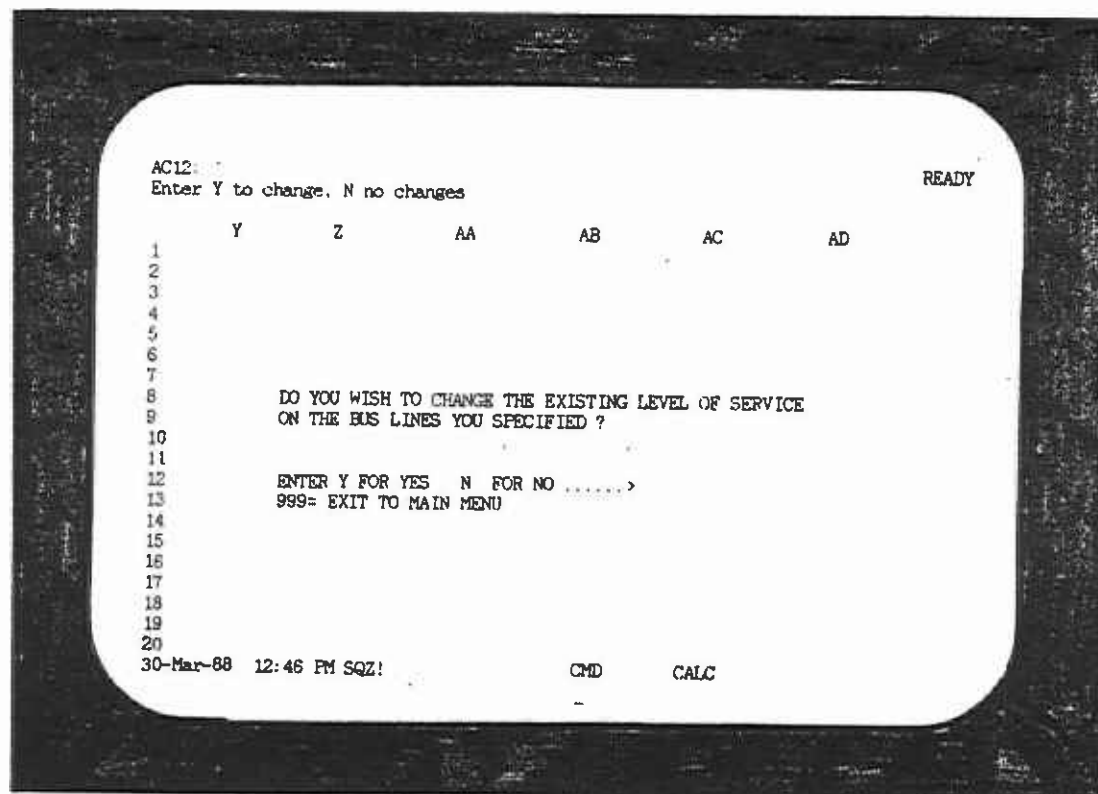
FIGURE 4.8

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If 'Y' was entered, the next screen will look like Figure 4.9. The data for the first line specified is displayed under the annual existing column.

Enter the day of the week to which the changes apply, then press Return. The program calculates 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 are desired. Otherwise, enter '0' on the last entry line and press Return. This will cause the program to cease modifying the level-of-service data.

```
AD37                                                              READY
Which day?

       Y        Z         AA        AB        AC        AD
21
22            MODIFY LEVEL OF SERVICE CHARACTERISTICS FOR A BUS LINE
23
24                      ANNUAL      ENTER  :  NEW
25                      EXISTING    NEW    :  ANNUAL
26            WEEK      WEEK        DAILY  :
27            LINE #          30           :
28            DIVISION         1           V
29            HOURS      127,908
30            MILES    1,383,605
31            PEAK BUSES      40
32            PASSENGERS 10,678,125
33            REVENUE   2,387,310
34            DAYS/YEAR
35
36            IS THE LINE DATA FOR A WEEKDAY SATURDAY OR SUNDAY ?
37            WEEK=1 .SAT=2 .SUN=3 ENTER HERE ..........>
38          * ENTER  "0" TO FINISH CHANGING LINE DATA
39            999=EXIT IMMEDIATELY TO MAIN MENU
40
30-Mar-88  12:47 PM SQZ!                    CMD       CALC
```

FIGURE 4.9

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Step 8--Printing the Output

The next six screens pertain to printing out the line cost data. The first of these screens (Figure 4.10) permits the user to view the level-of-service data. Enter 'SU' (screen up) or 'SD' (screen down) to view the dataset. The prompt asks for 'Y' to print the dataset, or 'N' to omit printing. If desired, use 999 to return directly to the main menu.

```
AC42: U                                                          READY
Print extracted data set?

        Y        Z        AA       AB       AC          AD
41               Do you wish to print the extracted data set?
42               ENTER  Y FOR YES, N FOR NO
43               999= EXIT TO MAIN MENU                 =====
44   >>>>>>>> ENTER   SD   TO PAGE DOWN DATA   SU   TO PAGE UP
        A        B        C        D        E          F          G
1    EXTRACTED ANNUAL LINE DATA FOR COSTING              Time:    12:39 PM
2
3    Annual conversion based on:            256 WEEKDAYS
4                                            51 SATURDAYS
5                                            58 SUNDAYS
6
7
8       DAY     LINE     DIV      HOURS      MILES    PEAK BUS        PASS
9    WEEK        30       1     127,908   1,383,605         40  10,678,125
10   SAT         30       1      22,485     229,351          0   2,244,580
11   SUN         30       1      20,520     221,734          0   1,668,370
12
13
14
15
30-Mar-88   12:49 PM SQZ!                   CMD       CALC
```

FIGURE 4.10

The next screen (Figure 4.11) displays the costs that can be allocated to the divisions from which bus lines are operated. These costs are not the total costs of operation, because costs allocated to the overall system are not yet included.

Figure 4.11 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 in Figure 4.11, the division being costed is Division 1, and only one bus line is evaluated, bus line 30. On the second line from the top, the prompt asks if the user desires a printout of this screen. Enter 'Y' or 'N' and press Return. A second prompt asks the user to align the paper and press Return to start printing.
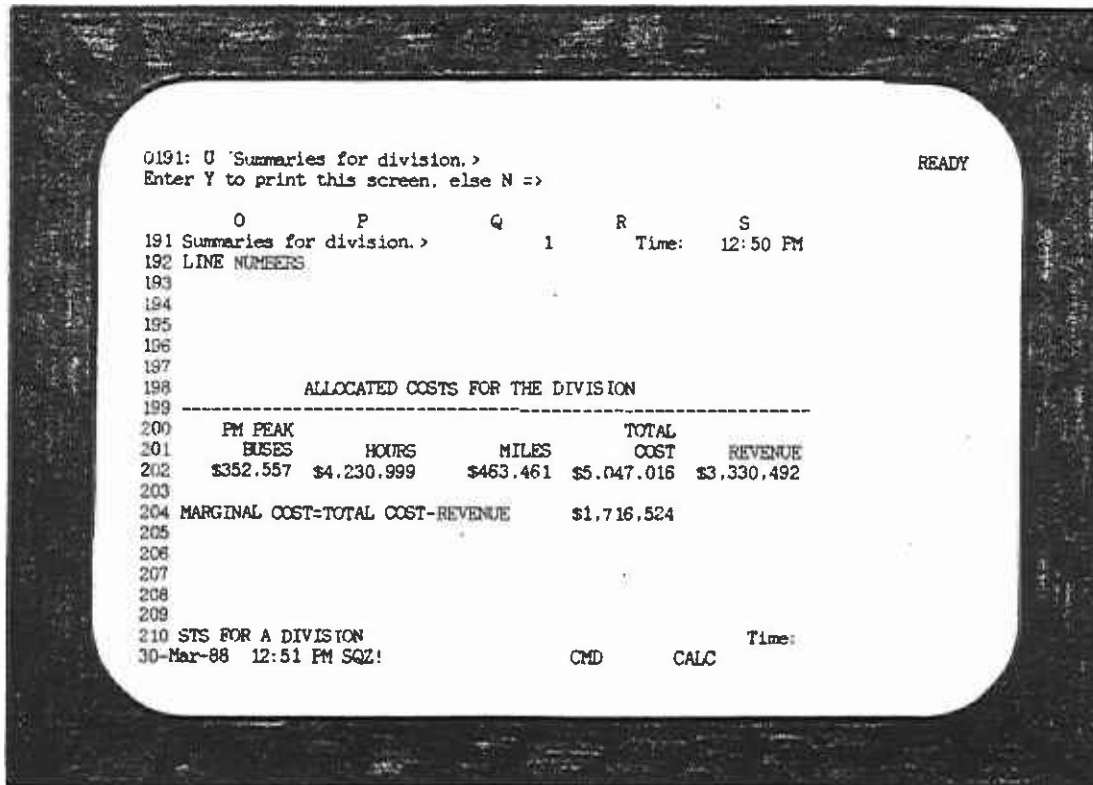
FIGURE 4.11

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The following screen (Figure 4.12) is 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 information 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 4.11 and 4.12 would be repeated for each division.
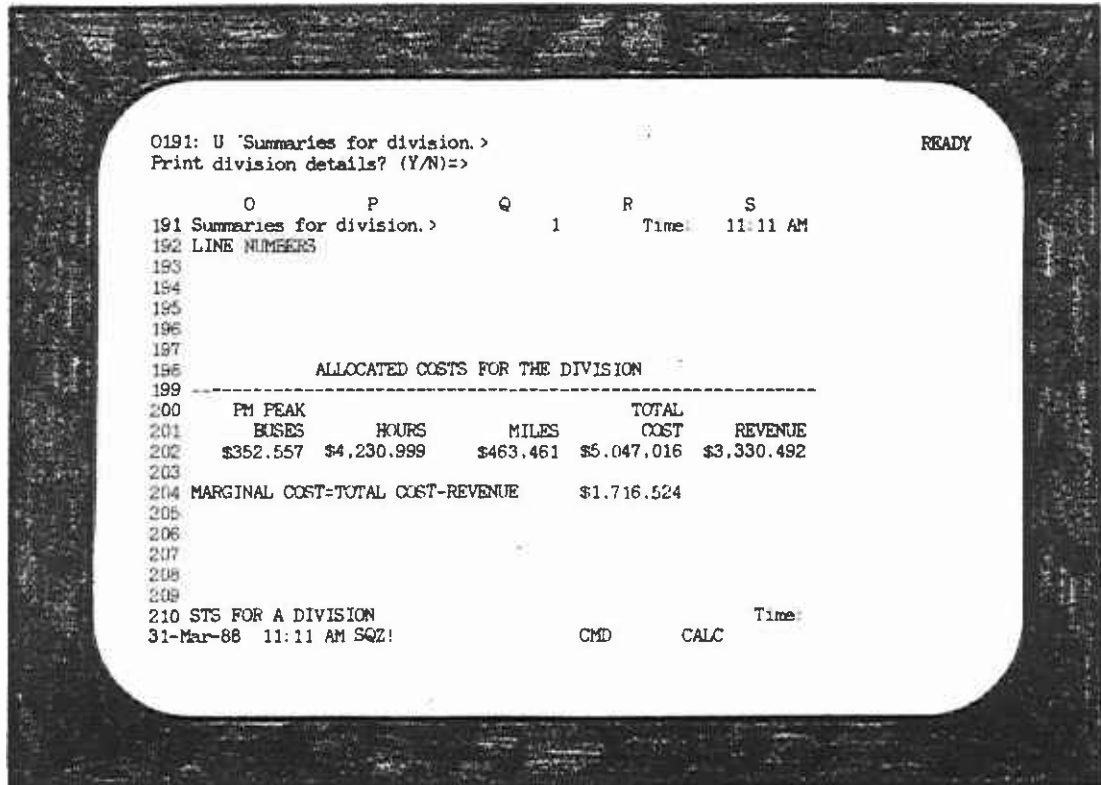
FIGURE 4.12

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The next three screens (Figures 4.13 through 4.15) contain the information for the last division that was costed. The user has the option of printing the dataset, cost summary, and system calculations. The prompts are identical to those discussed before.


```
0191: U 'Summaries for division.>                                    READY
Print database summary? (Y/N) ==>

          O           P           Q         R          S
191 Summaries for division.>                 1     Time:   12:50 PM
192 LINE NUMBERS
193
194
195
196
197
198              ALLOCATED COSTS FOR THE DIVISION
199 -----------------------------------------------------------------
200    PM PEAK                              TOTAL
201     BUSES       HOURS       MILES       COST      REVENUE
202    $352.557   $4,230,999   $463,461  $5,047,016  $3,330,492
203
204 MARGINAL COST=TOTAL COST-REVENUE       $1,716,524
205
206
207
208
209
210 STS FOR A DIVISION                              Time
30-Mar-88   12:53 PM SQZ!            CMD      CALC
```

FIGURE 4.13

23

```
0191: U  Summaries for division.>                              READY
Print cost details? (Y/N) =>

          O         P          Q        R        S
191 Summaries for division.>              1      Time:   11:11 AM
192 LINE NUMBERS
193
194
195
196
197
198             ALLOCATED COSTS FOR THE DIVISION
199 ----------------------------------------------------------------
200    PM PEAK                              TOTAL
201      BUSES       HOURS       MILES       COST     REVENUE
202    $352,557   $4,230,999   $463,461  $5,047,016  $3,330,492
203
204 MARGINAL COST=TOTAL COST-REVENUE        $1,716,524
205
206
207
208
209
210 STS FOR A DIVISION                              Time:
31-Mar-88  11:12 AM SQZ!              CMD      CALC
```

FIGURE 4.14


```
0191: U  Summaries for division.>                              READY
Print system calculations? (Y/N)=>

          O         P          Q        R        S
191 Summaries for division.>              1      Time:   12:50 PM
192 LINE NUMBERS
193
194
195
196
197
198             ALLOCATED COSTS FOR THE DIVISION
199 ----------------------------------------------------------------
200    PM PEAK                              TOTAL
201      BUSES       HOURS       MILES       COST     REVENUE
202    $352,557   $4,230,999   $463,461  $5,047,016  $3,330,492
203
204 MARGINAL COST=TOTAL COST-REVENUE        $1,716,524
205
206
207
208
209
210 STS FOR A DIVISION                              Time:
30-Mar-88  12:53 PM SQZ!              CMD      CALC
```

FIGURE 4.15

24

The next screen (Figure 4.16) contains the total cost information for all lines. It displays the total costs allocated to e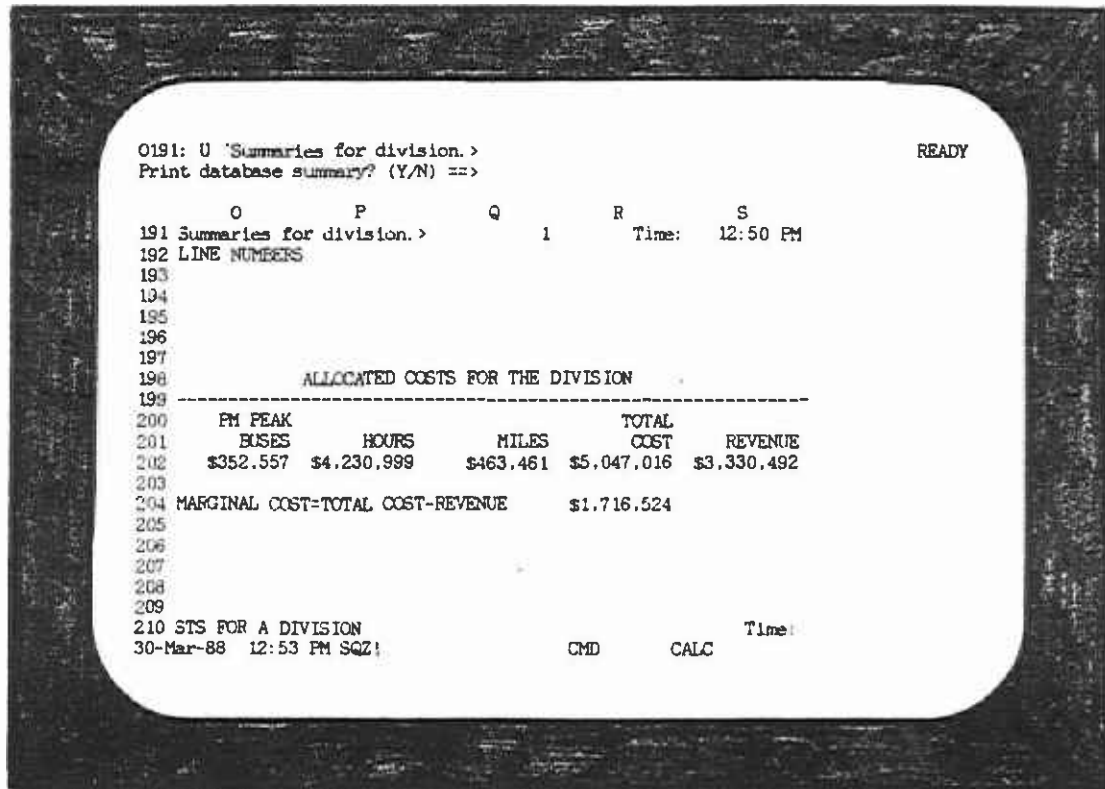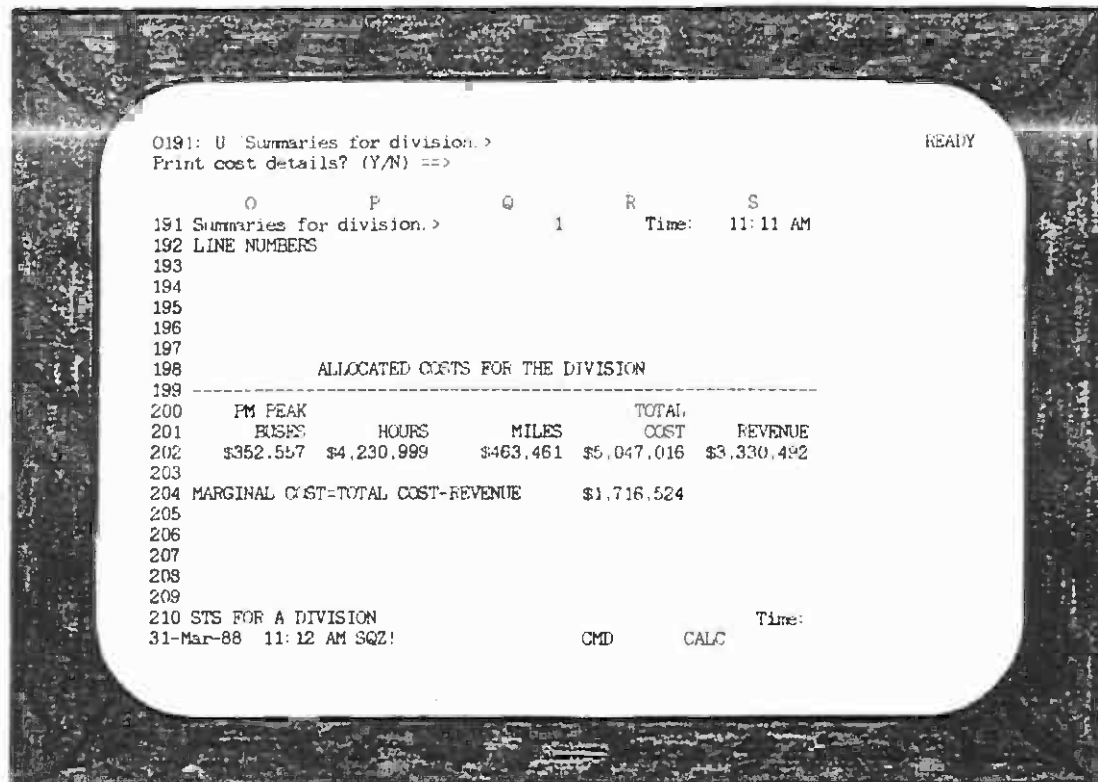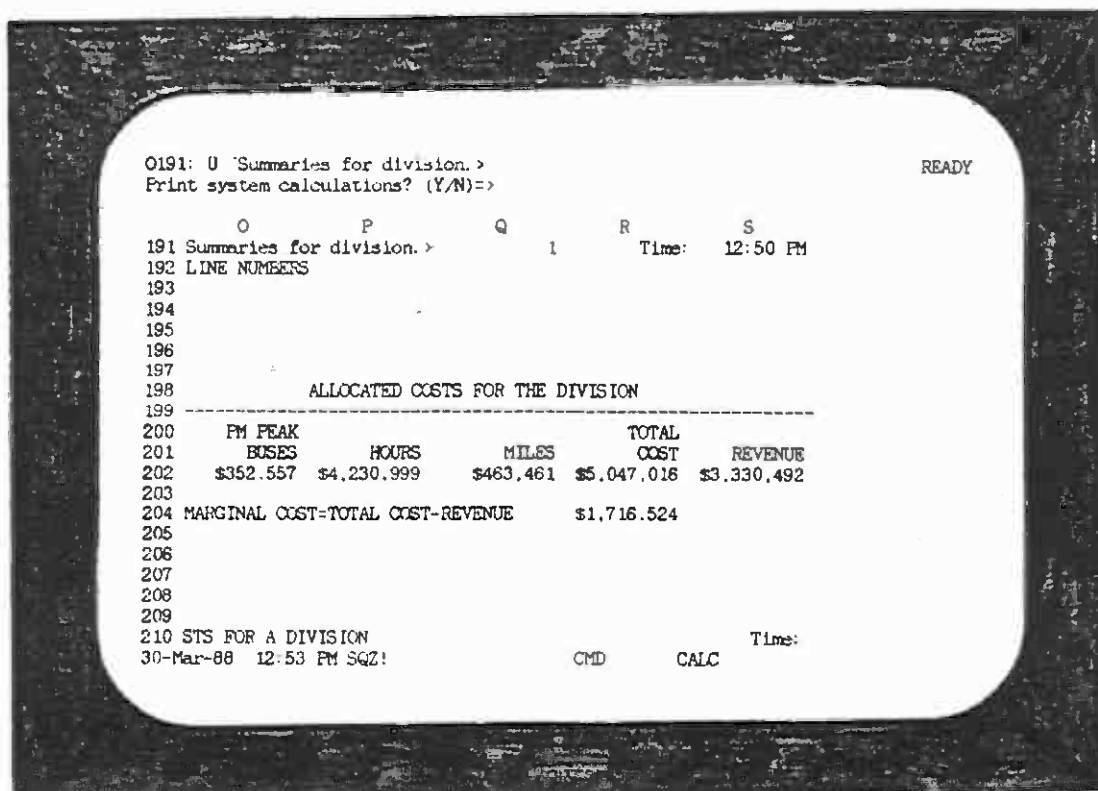ach division specified and the costs that were allocated among all the divisions, systemwide. The last two lines provide the marginal and full cost information for the lines specified.

```
AQ1: [W9]                                                              READY
Print final summary? (Y/N)

          AQ        AR         AS          AT          AU
 1                             FINAL SUMMARY SCREEN        Time:
 2                        ANNUAL ALLOCATED BUS OPERATING COSTS
 3
 4                   Pm Peak
 5    LEVEL OF       Buses       Hours        Miles      Passengers
 6    SERVICE          40       170,913     1,834,690    14,591,075
 7    ...............................................................
 8                             DIVISION SYSTEMWIDE   SYSTEMWIDE
 9                             COSTS NOT FULL        FULL
10    PM PEAK BUSES             $352,557      $90,822    $1,937,755
11    HOURS                   $4,230,999      $36,067      $123,383
12    MILES                     $463,461   $1,331,768    $1,331,768
13    PASSENGERS                     $0    $1,613,019    $1,764,807
14    -------------------------------------------------------------
15    COSTS                   $5,047,016   $3,071,675    $5,157,712
16    REVENUE                 $3,330,492
17    -------------------------------------------------------------
18
19    ..MARGINAL COSTS        $1,716,524   $3,071,675
20    ..FULL COSTS            $1,716,524                 $5,157,712
30-Mar-88   12:54 PM SQZ!                   CMD         CALC
```

FIGURE 4.16

Step 9--Return to Main Menu or Cost Another Line/Division

The final screen of the costing option (Figure 4.17) asks the user if he wishes to return to the Main Menu or continue costing. If the user wishes to continue costing, he is given the option to use either the same dataset or use the other one. For example, if the first costing was performed using the Tempdata dataset, the user can cost again with the Permdata dataset.


```
AC151:                                                            READY
Another costing? (Y/N)

        Y          Z          AA          AB          AC          AD
141
142
143
144
145
146
147
148
149
150
151     ANOTHER SET OF CALCULATIONS ? ===>
152     Y=  YES                                         =====
153     N=  NO
154     999=EXIT
155
156
157
158
159
160
30-Mar-88  12:54 PM SQZ!                    CMD      CALC
```

FIGURE 4.17

26
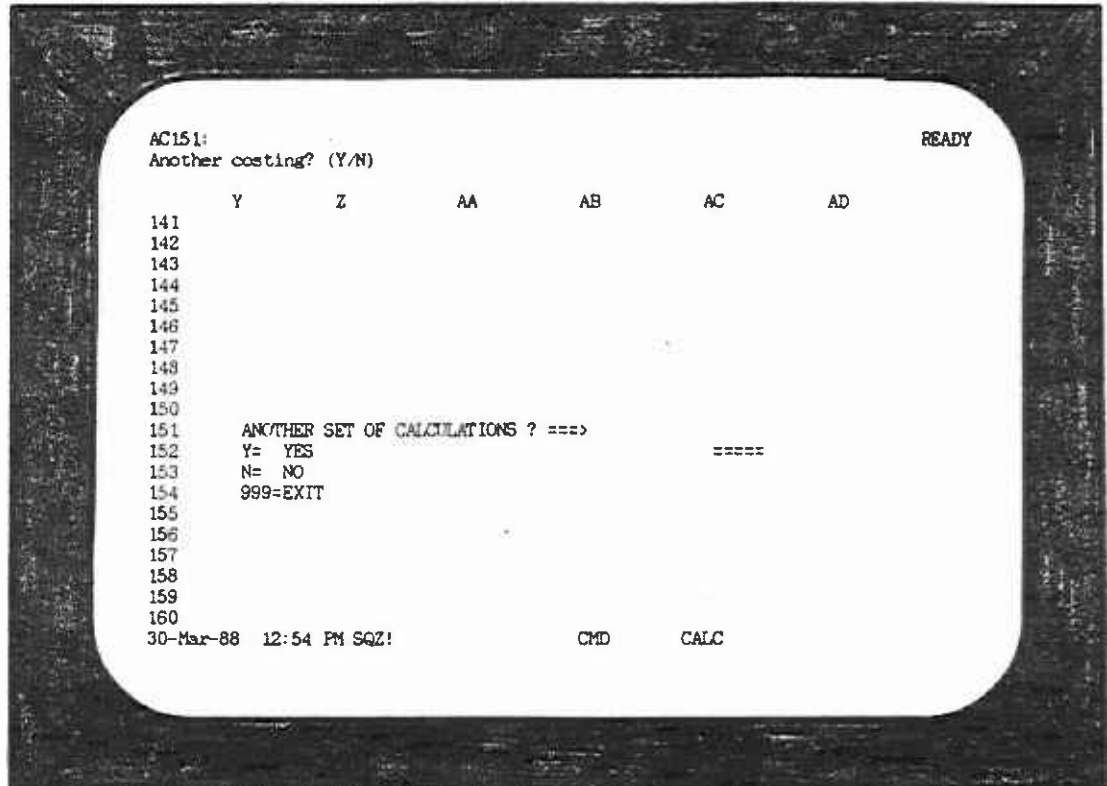
4.2   OPTION 2: CHANGING THE NUMBER OF DAYS

Option 2 allows the user to change 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 service. Thus, the number of weekdays could be reduced or increased.

The annual figures in the dataset are actually calculated from daily level-of-service data. The original bus line data that were used to create the dataset were all in daily totals for Bus Hours, Bus Miles, Passengers, and Revenue. The annual figures are calculated based on the current conversion rates specified in the program. These current rates are presented at the top of the dataset. The user should check to make sure that they are appropriate.

The following sequence of steps must be executed to change the number of days.

1.   Select Option 2 from the Main Menu.

2.   Select '1' or '0' (zero) to enter the changes into the Permdata or Tempdata files, respectively.

3.   The program will prompt the user to enter the line number and the new number of weekdays, saturdays, and sundays. If the user wishes to change <u>all</u> lines, 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 the day specified, he will get an error message. The user will be prompted to enter the BREAK key and 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 make the changes to the Permdata or Tempdata dataset, as specified, and will return to the Main Menu.

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4.3 OPTION 3: ADD/DELETE/REALLOCATE/UNDO/COST A LINE OR DIVISION

Option 3 allows the user to make changes to the Tempdata dataset and save those changes for future use. The user may:

- o   Add a line or division
- o   Delete a line or division
- o   Reallocate lines among divisions
- o   Undo any of the above changes
- o   Cost the changed lines or divisions

4.3.1 Adding Bus Lines or Divisions

Step 1--Main Menu

If you do not have the Main Menu up on the screen, go to Chapter 2 now.

Step 2--Choosing Option 3

From the main menu select Option 3. A screen like Figure 4.18 will appear, notifying the user that he is in Option 3, which allows him to change the Tempdata dataset by adding, deleting, or reallocating bus lines or divisions and allows the user to cost lines or divisions. Press Return to move to the Option 3 Menu.
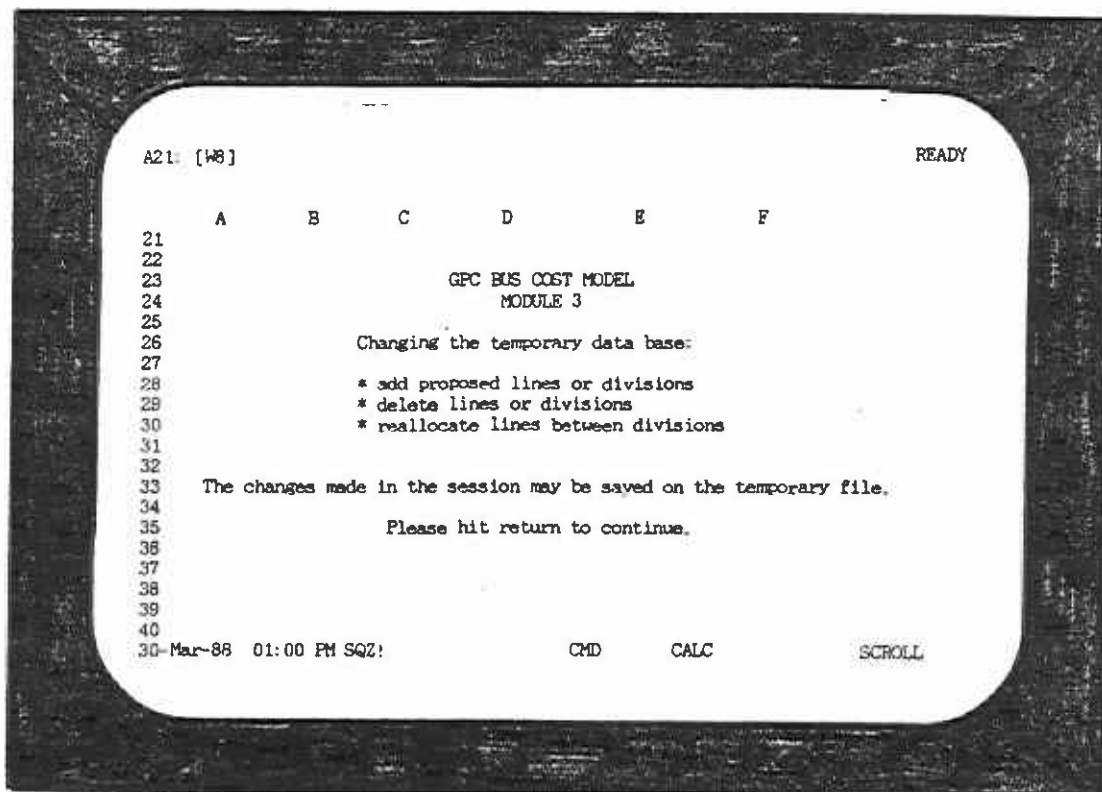
FIGURE 4.18

28

Step 3--Select Option

Figure 4.19 has a menu displayed on the second line from the top.
Under this line is a brief description of the menu item. Use the
cursor keys to review each of the menu selections:

1. Add (a line or division)
2. Delete (a line or division)
3. Reallocate (a line to a different division)
4. Undo
5. Cost

If the user wishes to add a line, move the cursor to ADD and
press Return.
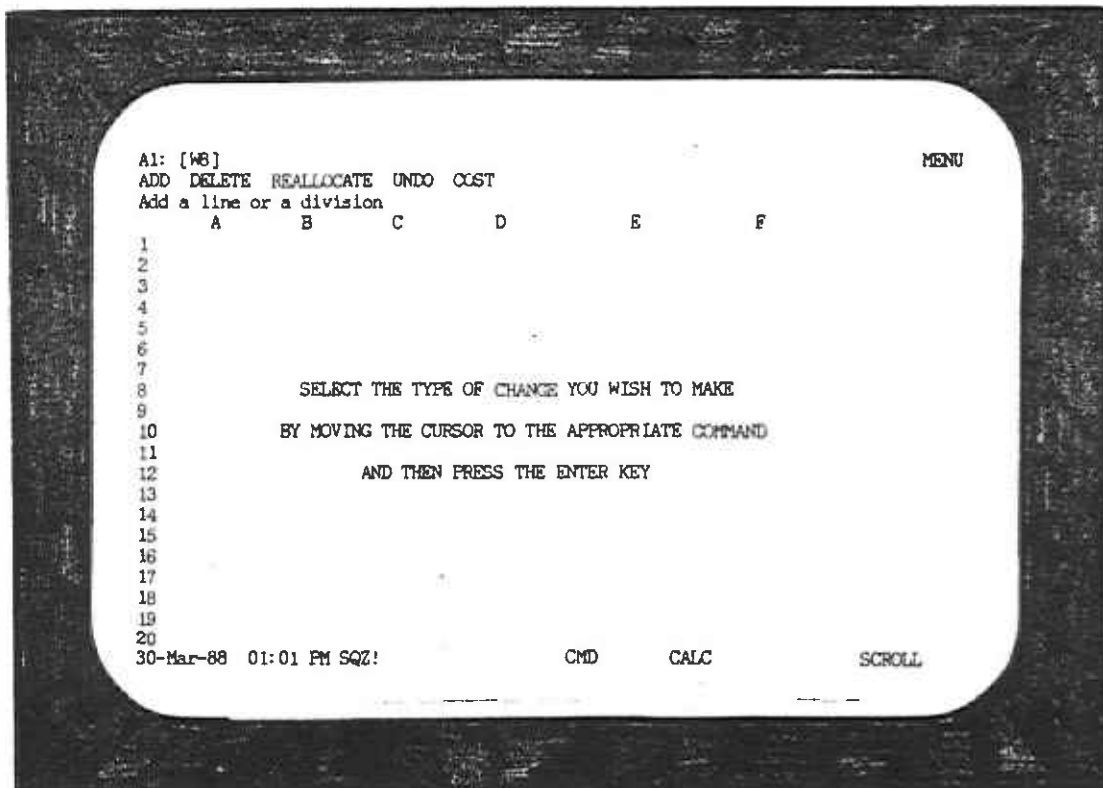
FIGURE 4.19

Step 4--Select Line or Division

The next screen (Figure 4.20) asks whether the user wishes to add a line or a division. Both procedures are similar. If the user wishes to add a line, move the cursor to LINE and press Return. If the user wishes to add a division, move the cursor to DIVISION and press Return.


```
A1: [WB]                                                 MENU
LINE  DIVISION
Add a proposed line
      A       B       C       D         E         F
1
2
3
4
5
6
7
8           SELECT THE TYPE OF CHANGE YOU WISH TO MAKE
9
10        BY MOVING THE CURSOR TO THE APPROPRIATE COMMAND
11
12               AND THEN PRESS THE ENTER KEY
13
14
15
16
17
18
19
20
30-Mar-88  01:01 PM SQZ!              CMD      CALC           SCROLL
```

FIGURE 4.20

30

Step 5--Data Entry

Figure 4.21 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 line or division data. The cursor will be resting to the right of the line or division number. Enter the number of the new bus line or division here and press the 'Down Arrow' key to move to the next item, which is Days.


```
L6: U [W16]                                              READY
Please input new line number ==>

       J         K          L          M        N        O
                      COSTING PROPOSED BUS LINES
1
2
3    -----Enter daily operating statistics for up to 50 bus lines.
4    -----The day of the week must be entered in CAPITALS.
5
6            LINE  NO.                    DAILY        ANNUAL
7                                         TOTALS       TOTALS
8            DAY (WEEK,SAT,SUN)                        BASED ON #
9            # DAYS IN YEAR                       <......DAYS IN YEAR
10           DIVISION #
11           HOURS                                            0
12           MILES                                            0
13           PEAK BUSES                                       0
14           PASSENGERS                                       0
15           REVENUE                                          0
16           INPUT THE CHANGE ?
17           (Y=YES,N=NO)
18
19
20
30-Mar-88  01:02 PM SQZ!              CMD                 SCROLL
```
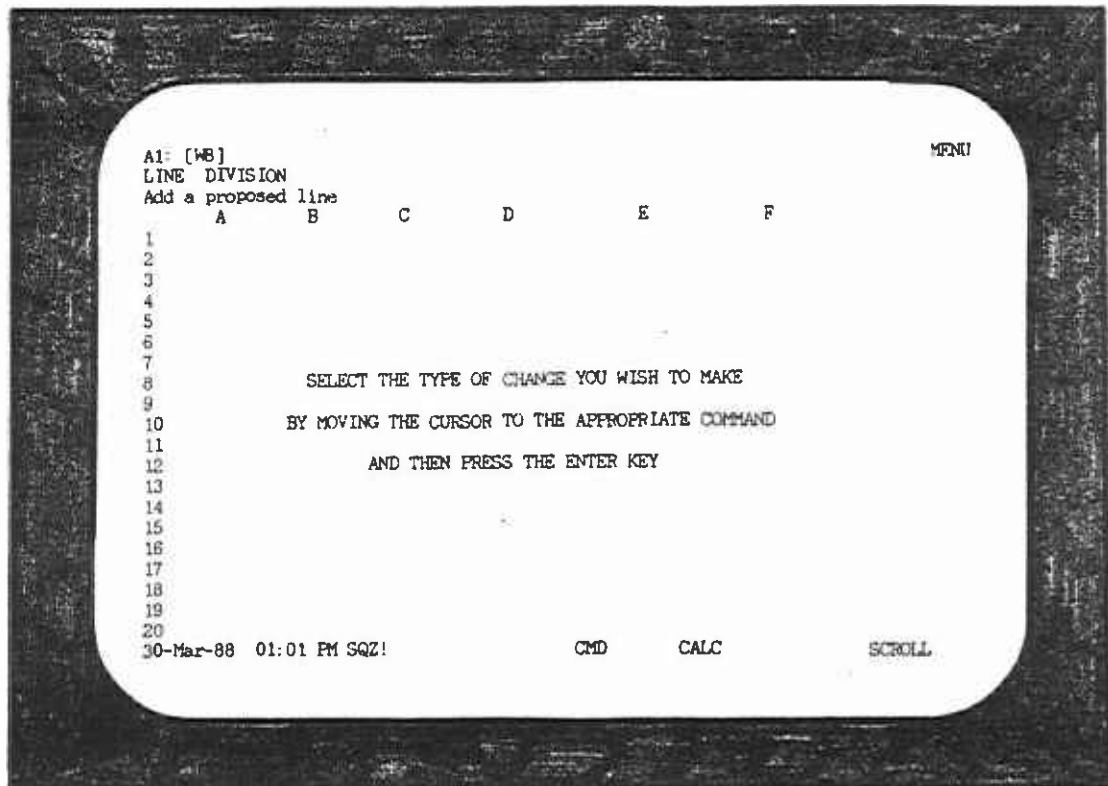
FIGURE 4.21

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Figure 4.22 shows a completed line data entry screen. The annual totals column is calculated by the program. 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 are specified. If the user wishes to change these, he must use Option 2.

When the bus line or division data entry is completed, press Return twice. A prompt will appear at the top of the screen asking whether the user wishes to create another line/division. If the user wishes merely to add one line/division , he enters '0' and presses Return.
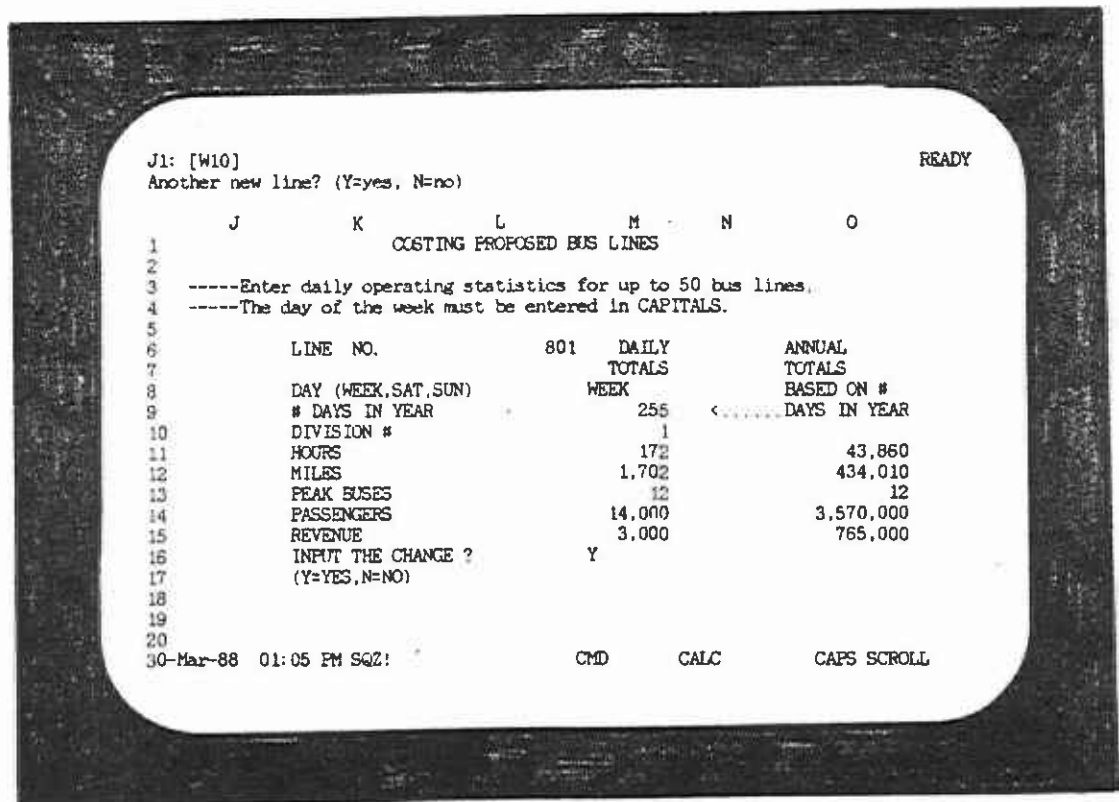
FIGURE 4.22

LINES

Bus line numbers must be between 800 and 849. 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, or SUN) in upper case letters. In
any one run, the user can enter up to fifty new bus lines.

DIVISIONS

Bus division numbers entered cannot be greater than 20 and cannot
be the number of an existing division. If the user creates a new
division, he may also create a new set of bus lines for the
division using this option. Even though the program does not
check to make sure these new lines are between 800 and 849, the
user must confine himself to this set of numbers.

CAUTION: If the user does not end the Option 3 session with the
COST option (see Section 4.5 of this chapter), changes such as
adding a line or division will not be saved to the Tempdata
dataset and changes will be lost.

4.3.2 Deleting a Line or Division

Steps 1 and 2

These are the same as adding a line or division.

Step 3

When the Primary file has been loaded, the Option 3 Menu will be
displayed. To delete a line or division, move the cursor over to
DELETE and press Return.

Step 4

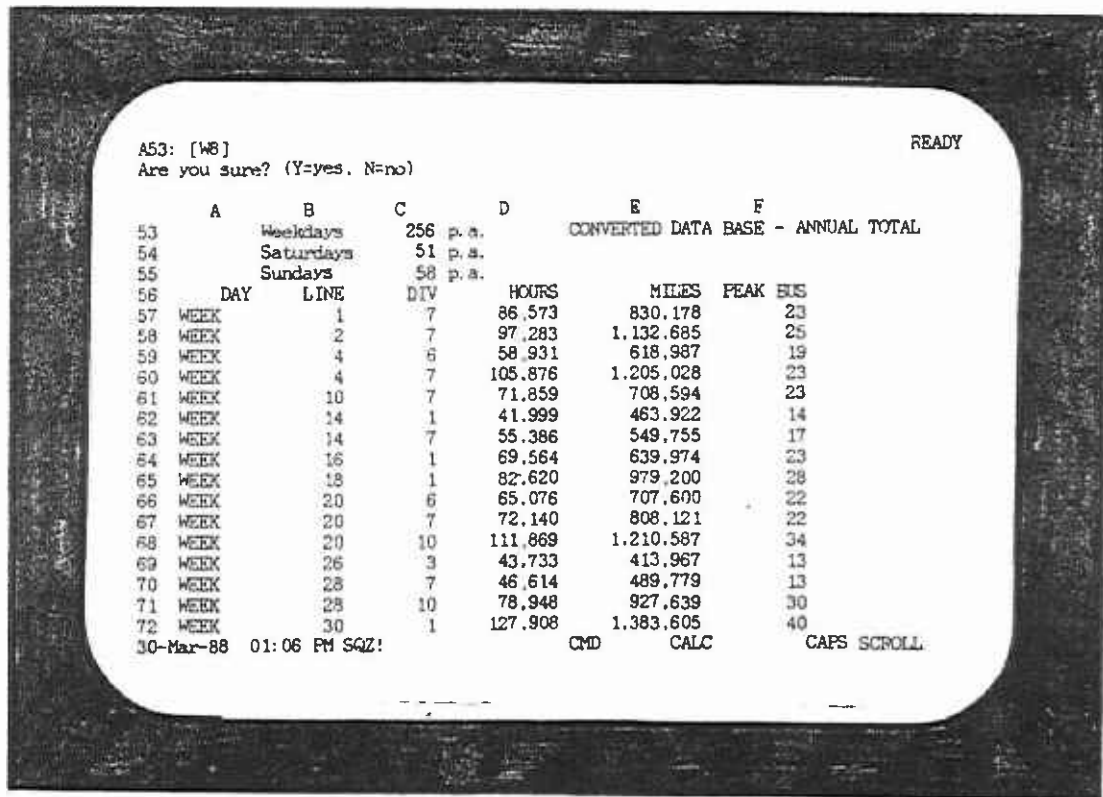The next screen (Figure 4.23) displays the top of the dataset. At the top line is a prompt which checks to make sure that the user really wants to move into the delete mode.

Enter 1 and press Return to continue.

A53: [W8]   READY
Are you sure? (Y=yes, N=no)

	A	B	C		D	E	F	
53		Weekdays	256	p.a.		CONVERTED DATA BASE - ANNUAL TOTAL		
54		Saturdays	51	p.a.				
55		Sundays	58	p.a.				
56	DAY	LINE	DIV		HOURS	MILES	PEAK BUS	
57	WEEK	1	7		86,573	830,178	23	
58	WEEK	2	7		97,283	1,132,685	25	
59	WEEK	4	6		58,931	618,987	19	
60	WEEK	4	7		105,876	1,205,028	23	
61	WEEK	10	7		71,859	708,594	23	
62	WEEK	14	1		41,999	463,922	14	
63	WEEK	14	7		55,386	549,755	17	
64	WEEK	16	1		69,564	639,974	23	
65	WEEK	18	1		82,620	979,200	28	
66	WEEK	20	6		65,076	707,600	22	
67	WEEK	20	7		72,140	808,121	22	
68	WEEK	20	10		111,869	1,210,587	34	
69	WEEK	26	3		43,733	413,967	13	
70	WEEK	28	7		46,614	489,779	13	
71	WEEK	28	10		78,948	927,639	30	
72	WEEK	30	1		127,908	1,383,605	40	

30-Mar-88   01:06 PM SQZ!   CMD   CALC   CAPS SCROLL

FIGURE 4.23

34

Step 5--Enter Line or Division Number to be Deleted

This step is composed of two screens which appear similar but which have different prompts at the top.

LINES

The first screen (Figure 4.24) asks which line the user wishes to delete. Enter the line 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 now asks for the division number of the line. Enter the division number and press Return.

```
M27: [W9] 30                                                READY
Which line do you wish to delete?

           J          K          L          M      N          O
    21
    22
    23
    24
    25
    26
    27    Which line do you wish to delete?              30
    28                                                   ====
    29    *** Enter 999 if you wish to delete all lines
    30
    31
    32
    33    Which division to you wish to delete?           1
    34                                                   ====
    35    *** Enter 999 if you wish to delete all divisions
    36
    37
    38
    39
    40
30-Mar-88  01:11 PM SQZ!              CMD      CALC       CAPS SCROLL
```
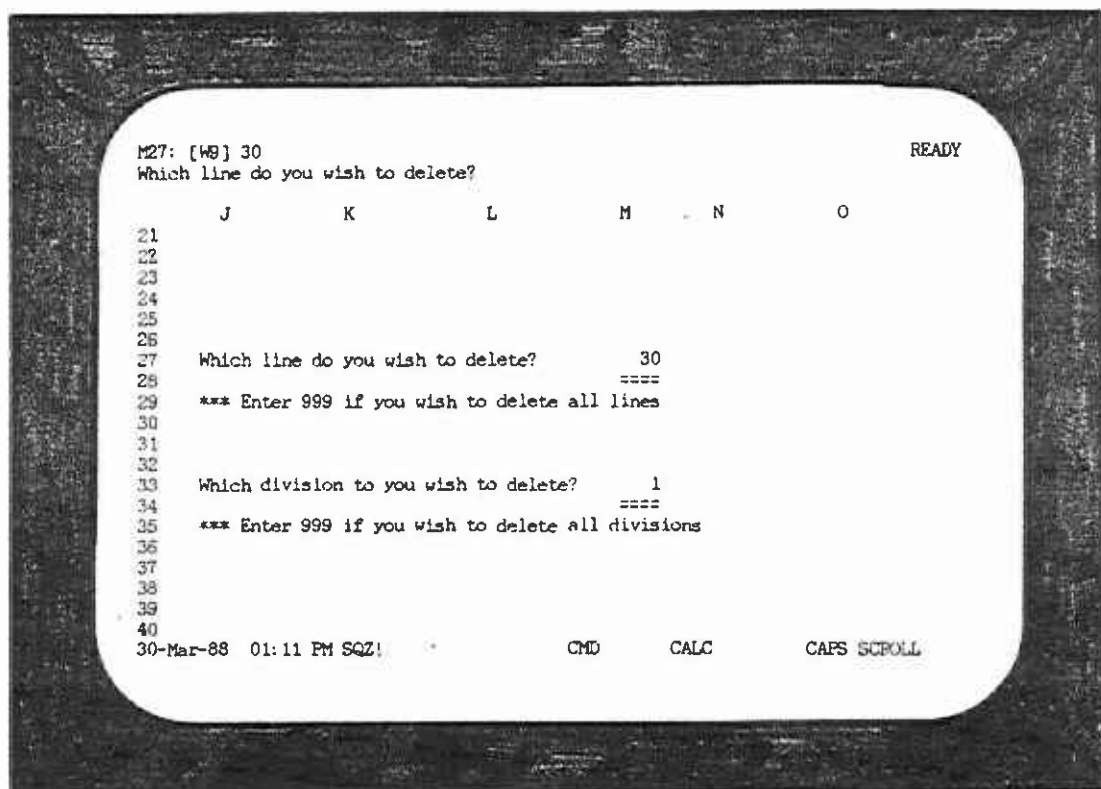
FIGURE 4.24

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DIVISIONS

Deleting a division (Figure 4.25) uses the same screen as 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.

Step 6--Delete Another Line or Division or Exit

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

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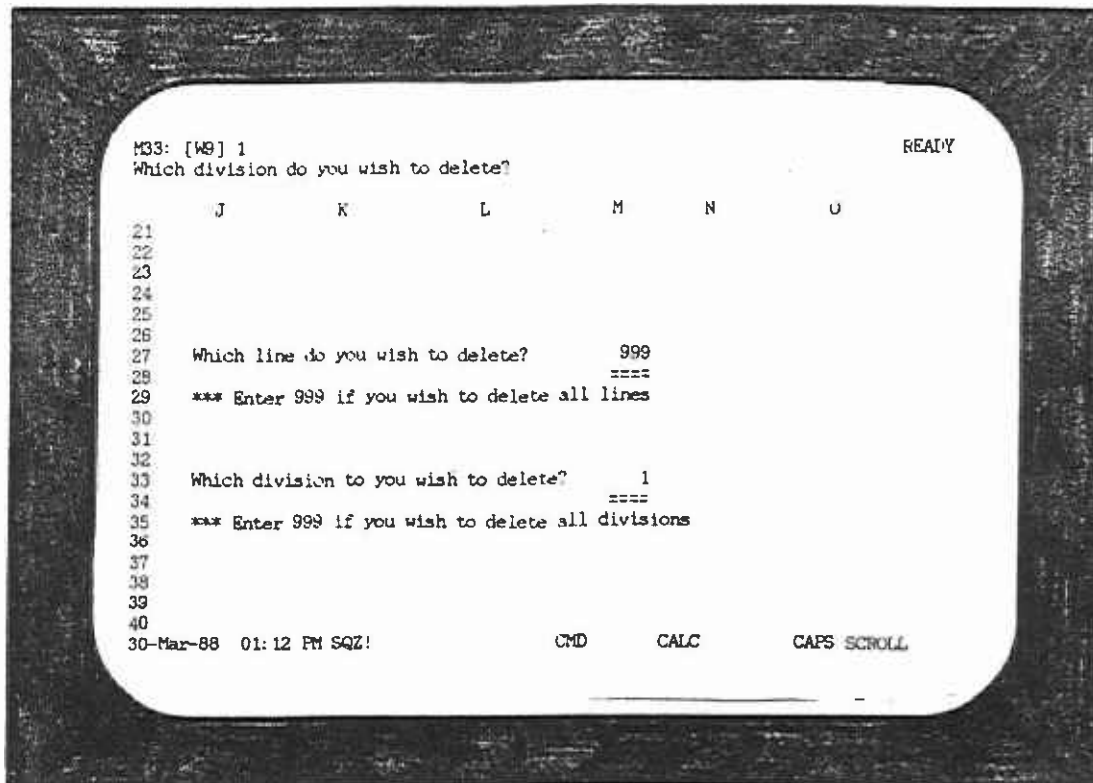

FIGURE 4.25

4.3.3 Reallocating Between Divisions

Steps 1 and 2

Repeat these steps as for adding a bus line. This will bring you to the Option 3 Menu.

Step 3

Select the reallocate function by moving the cursor to REALLOCATE and press Return.

Step 4

The next screen (Figure 4.26) is a submenu which has two choices: reallocate a LINE of one division to another or reallocate all of one DIVISION to another.

```
A1: [W8]                                                        MENU
DIVISION  LINE
Reallocate all of the division to another division
          A        B        C        D           E          F
 1
 2
 3
 4
 5
 6
 7
 8            SELECT THE TYPE OF CHANGE YOU WISH TO MAKE
 9
10         BY MOVING THE CURSOR TO THE APPROPRIATE COMMAND
11
12              AND THEN PRESS THE ENTER KEY
13
14
15
16
17
18
19
20
30-Mar-88  01: 13 PM SQZ!              CMD      CALC      CAPS SCROLL
```
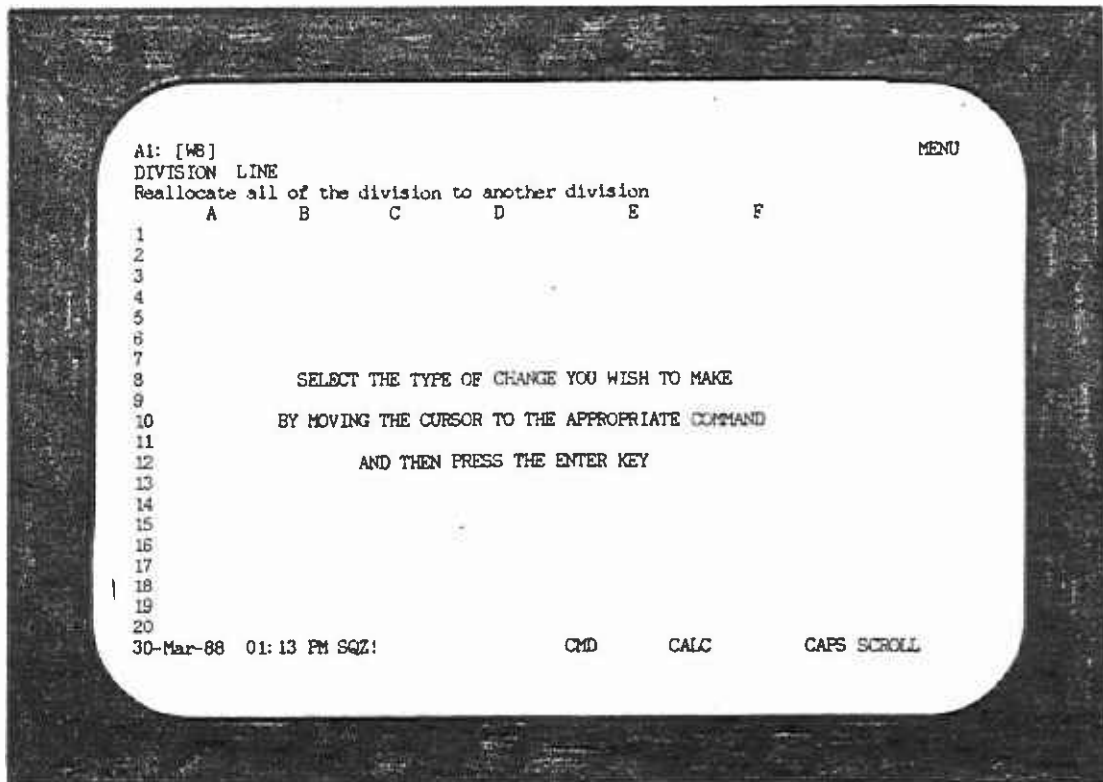
FIGURE 4.26

37

LINES

If the user wishes to reallocate a line of a division to another
division move the cursor to LINE and press Return. The screen
then changes to the first half of the dataset (Figure 4.27). 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.

	A	B	C		D	E	F	
A53: [w8]								READY
Which line do you want to change?								
53		Weekdays	256	p. a.		CONVERTED DATA BASE - ANNUAL TOTAL		
54		Saturdays	51	p. a.				
55		Sundays	58	p. a.				
56	DAY	LINE	DIV		HOURS	MILES	PEAK BUS	
57	WEEK	1	7		86.573	830.178	23	
58	WEEK	2	7		97.283	1,132.685	25	
59	WEEK	4	6		58.931	618.987	19	
60	WEEK	4	7		105.876	1,205.028	23	
61	WEEK	10	7		71.859	708.594	23	
62	WEEK	14	7		55.386	549.755	17	
63	WEEK	20	6		65.076	707.600	22	
64	WEEK	20	7		72.140	808.121	22	
65	WEEK	20	10		111.869	1,210.587	34	
66	WEEK	26	3		43.733	413.967	13	
67	WEEK	28	7		46.614	489.779	13	
68	WEEK	28	10		78.948	927.639	30	
69	WEEK	33	6		37.001	488.070	8	
70	WEEK	33	10		68.748	882.683	18	
71	WEEK	38	10		46.079	489.600	12	
72	WEEK	40	5		84.023	975.299	29	
30-Mar-88	01:14 PM SQZ!				CMD	CALC	CAPS SCROLL	

FIGURE 4.27

38

The following screen (Figure 4.28) asks for the division in which the line number is currently found. Enter the division number and press Return. The final prompt at this step asks to which division the line should be reallocated (Figure 4.29). Enter the new division number and press Return.

```
A53: [W8]                                                     READY
In which division is the line?

         A       B        C        D          E        F
                                       CONVERTED DATA BASE - ANNUAL TOTAL
53              Weekdays    256 p.a.
54              Saturdays    51 p.a.
55              Sundays      58 p.a.
56       DAY    LINE     DIV      HOURS      MILES  PEAK BUS
57    WEEK        1        7      86,573    830,178       23
58    WEEK        2        7      97,283  1,132,685       25
59    WEEK        4        6      58,931    618,987       19
60    WEEK        4        7     105,876  1,205,028       23
61    WEEK       10        7      71,859    708,594       23
62    WEEK       14        7      55,386    549,755       17
63    WEEK       20        6      65,076    707,600       22
64    WEEK       20        7      72,140    808,121       22
65    WEEK       20       10     111,869  1,210,587       34
66    WEEK       26        3      43,733    413,967       13
67    WEEK       28        7      46,614    489,779       13
68    WEEK       28       10      78,948    927,639       30
69    WEEK       33        6      37,001    488,070        8
70    WEEK       33       10      68,748    882,683       18
71    WEEK       38       10      46,079    489,600       12
72    WEEK       40        5      84,023    975,299       29
30-Mar-88  01:14 PM SQZ!              CMD     CALC      CAFS SCROLL
```

FIGURE 4.28

39

```
A53: [W8]                                                          READY
Reallocate to which division?

         A         B          C        D            E          F
53                 Weekdays   256 p.a.        CONVERTED DATA BASE - ANNUAL TOTAL
54                 Saturdays   51 p.a.
55                 Sundays     58 p.a.
56       DAY       LINE       DIV      HOURS        MILES      PEAK BUS
57   WEEK           1          7       86,573       830,178        23
58   WEEK           2          7       97,283     1,132,685        25
59   WEEK           4          6       58,931       618,987        19
60   WEEK           4          7      105,876     1,205,028        23
61   WEEK          10          7       71,859       708,594        23
62   WEEK          14          7       55,386       549,755        17
63   WEEK          20          8       65,076       707,600        22
64   WEEK          20          7       72,140       808,121        22
65   WEEK          20         10      111,869     1,210,587        34
66   WEEK          28          3       43,733       413,967        13
67   WEEK          28          7       46,614       489,779        13
68   WEEK          28         10       78,948       927,639        30
69   WEEK          33          8       37,001       488,070         8
70   WEEK          33         10       68,748       882,683        18
71   WEEK          38         10       46,079       489,600        12
72   WEEK          40          5       84,023       975,299        29
30-Mar-88   01:15 PM SQZ!               CMD        CALC        CAPS SCROLL
```

FIGURE 4.29

This screen (Figure 4.30) 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 dataset line by line.

DIVISIONS

The process is similar to reallocating a line between divisions. Move the cursor to DIV in order to shut down a division and reallocate all of the lines. Now the user will be specifying which division he wishes to shut down and the division to which the bus lines should be transferred.

FIGURE 4.30

41
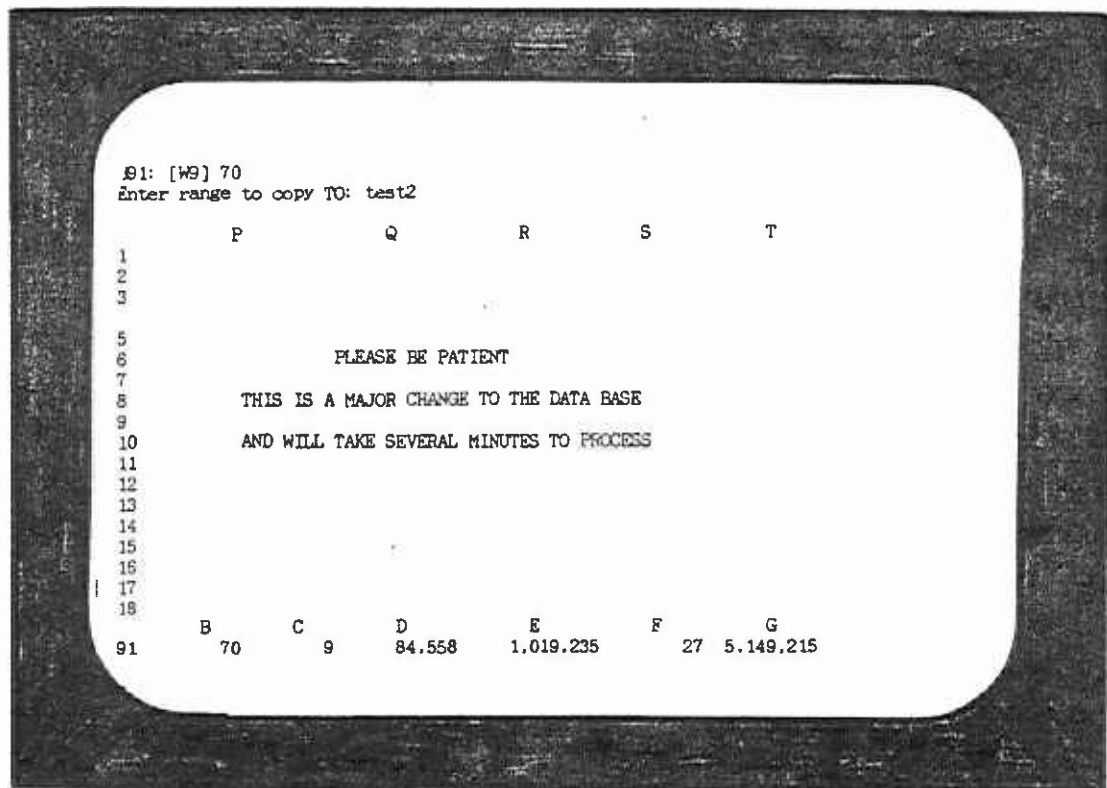
4.3.4 Undo

If the user chooses the UNDO function of the Option 3 Menu, the pragram returns the user to the Main Menu and does not save any changes made through the Add, Delete, or Reallocate functions.

4.3.5 Costing Lines or Divisions

With this option, the user may cost existing lines or divisions or new lines or divisions created with the Add function. Move the cursor to COST and press Return. If the user wishes to cost newly created lines, select the Tempdata file in Step 2 by typing '0'.

For further instructions on how to use the COST function of the program, refer to Section 4.1 of this chapter.

4.4 OPTION 4: UPDATING THE PRIMARY DATASET

Two steps are involved in this process.

    1.   Editing the new dataset.
    2.   Copying it into the PRIMARY module.

Editing the New Dataset

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

Step 1

Load LOTUS with the floppy disk containing the new file in one of the disk drives:

Step 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.

Step 3

Load the new file into the LOTUS work area by executing the file-import command:

        /FI(filename)

Step 4

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

Step 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 4.31. Compare this with Figure A-4.6.

Step 6

Save the file using the file-save command:

>   /FSbuscost.wk!, where 'buscost' is the new
>   filename.

IMPORTANT: The newly edited file should be named 'BUSCOST,
because the progam to update the PRIMARY dataset is written to
read this file name.

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

FIGURE 4.31

THE DOWNLOAD DATAFILE WITH "DAY" COLUMN INSERTED

43

Updating the Primary Dataset

Copying the newly edited dataset is an automatic process. The copying is done by selecting Option 4 of the Main Menu.

Update the PRIMARY dataset as follows.

Step 1

Call up the Bus Cost program Main Menu as described in Chapter 1.

Step 2

Select Option 4 of the Main Menu.

Step 3

The program will prompt the user to ascertain whether or not the new dataset has been edited. If not, the program will return the user to the Main Menu.

Step 4

The program will take a few seconds to copy the new dataset (BUSCOST.WK!) into the PRIMARY dataset. When finished, the program will return the user to the Main Menu.

Step 5

Create new Permdata and Tempdata working files, as explained in Section 4.5 below.

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4.5 OPTION 5:   CREATING NEW PERMDATA AND TEMPDATA DATASETS

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

Step 1

From the Main Menu, select Option 5.

Step 2

Enter '1' to create the Permdata dataset, or '0' (zero) to create the Tempdata dataset.

Step 3

The program will prompt the user to enter the total number of weekdays, saturdays, and sundays in a year.

Step 4

The program then creates the dataset and returns the user to the Main Menu.

Step 5

The above steps are repeated to create the other dataset.

4.6 OPTION 6:   EXIT THE BUS COST MODEL

The exit option allows the user to exit either to DOS or LOTUS. Select the EXIT option of the Main Menu and enter 'D' to exit to DOS or enter 'L' to exit to LOTUS.

5. HOW TO READ AND USE THE OUTPUT

After calculating bus operation costs, the user can print out various parts of the calculations. This chapter describes and explains the contents of the various printouts. This chapter is organized to follow the same order as the options to print.

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

5.1 PRINTOUT 1: SUMMARY OF ANNUAL LINE DATA

The first printout (Figure 5.1) provides a copy of the annual level-of-service data for the bus lines costed. In this example, bus line number 30 was specified for all days of the week. The printout shows the Annual Revenue, Bus Hours, Bus Miles, Passengers, and Cash Box Revenue for weekdays, saturdays, and sundays. Peak Buses are not annualized. They represent the scheduled number of buses operating on a weekday afternoon between 3:00 p.m. and 6:00 p.m.

5.2 PRINTOUT 2: DIVISION COST SUMMARIES

The second printout (Figure 5.2) is a summary of the partial cost of operating the bus lines specified. The program classifies costs as attributable to a single division and costs shared by all divisions. Division costs are the costs that can be attributed to a single division.

In this example, only bus line 30 was specified, which is operated only out of Division 1. Therefore, there is only one division summary printout. If additional bus lines which operated out of other divisions were specified, each division would have an individual printout.

The line numbers for 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 printout. Total cost ($4,931,072 in this example) consists of cost elements that can be allocated to the level-of-service variables P.M. Peak Buses, Bus Hours, and Bus Miles. This cost is the incremental cost of operating the bus lines out of the division. This divisional cost is a partial cost, because the cost of the system is not included, nor are costs allocated to other possible divisions. Marginal Cost is defined as this total divisional cost minus revenue. In this example, the

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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 5.1

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 5.2

marginal cost is in parentheses, indicating that it is negative; that is, revenue exceeds the costs to date.

5.3   PRINTOUT 3:   ALLOCATION OF ANNUAL COSTS FOR A DIVISION

This printout displays division costs and calculates operating costs for divisions.   The printout has three major parts:

1.   Allocation of costs to P.M. Buses,
2.   Allocation of costs to Bus Hours, and
3.   Allocation of costs to Bus Miles.

Each line of the printout 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 printout has been allocated to P.M. Peak Buses, because these budget items are related to the number of Peak Buses supplied by a division.   In the second part of the printout, each budget line item is related to the Bus Hours level-of-service measure.   In the third part of the printout budget line items are related to Bus Miles.

There are three types of relationships:

o   Direct relationships occur when costs vary directly proportionate to changes in a level-of-service measure.

o   Stepwise relationships vary in discrete increments once thresholds have been exceeded by level-of-service variables.

o   Fixed relationships are constants and do not vary with level-of-service measures.

In the division printout, all the budget line items are stepwise variables.   An explanation of each of the columns in the printout will explain how the stepwise relationships are calculated.

The first column in Figure 5.3 refers to type of variable.   Each line is a stepwise division-based variable (called Step D, for division).   The second column is the fiscal year cost for the line item.   The third column FY BASE is the total level-of-service measure for the system.

In the first section of the printout, 1987 refers to the number of buses in the entire bus system.   In the second section, (Column 3) 107165000 refers to the total Bus Miles 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).

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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 5.3

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 5.3

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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. Where costs are direct, the step size is one, meaning that costs will be a continuous function of the level-of-service.

The number of steps generated (Column 5) is calculated by dividing the total level-of-service measure (e.g., Peak Buses or Annual Bus Hours) by the step size. Column 6 is the step cost. This is determined by dividing the FY COST by the FY BASE. The seventh column, Annual Cost, is the product of multiplying the step cost by the number of steps.

To interpret the output, division costs for bus line 30 is used as an example. Annual level-of-service data for all the buses specified that run out of Division 1 are shown at the top of the spereadsheet. In this case only one line is specified. If more than one bus line had been specified, all the level-of-service measures for lines operating out of Division 1 would be shown here. They are copied to their corresponding sections for the cost calculations.

The first budget line item in the first section of the printout (P.M. 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, meaning that there must be a reduction of at least six peak buses before one service mechanic can be saved. A service mechanic cost $31,945 in 1986. Since there are 45 peak buses on line 30, cutting all of these would save seven service mechanics (45 peak buses/step size of 6), for a total savings of $223,615 7*31,945).

Each budget line item cost is calculated as above. The total cost of operation for each level-of-service measure is given in the last row of each section. These totals are summarized at the bottom of the printout in the "divisional cost summary."

5.4 PRINTOUT 4: COST DETAILS

The fourth printout (Figure 5.4) is a summary of all the division costs plus the pooled or systemwide costs. In this example, since bus line 30 operates only out of Division 1, only the costs for Division 1 are given. After the costs of each division are displayed, the system costs are displayed. These are displayed in two forms:

o   System-Full: Does not include fixed costs
o   System+Full: Includes fixed costs

Marginal Cost is the annual incremental cost of running the bus

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   41
BUSES

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 5.4

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 $	Department	Item
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 5.4

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line, including the divisional and pooled systemwide costs but not fixed costs.

The final line is the total cost of running the bus line including fixed costs.

5.5   PRINTOUT 5:   DATASET SUMMARY BY DIVISION

Figure 5.5 is 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.

5.6   PRINTOUT 6:   ANNUAL OPERATING COSTS FOR ALL DIVISIONS

Figure 5.6 is the systemwide printout.   Recall that the model calculates the cost of operating buses by allocating the costs to individual divisions, where possible.   However, there are some costs which cannot easily be allocated to a single division, because they are shared by all divisions.   The systemwide displays estimates of these shared or pooled costs.   For example, planning, administration, central stores, central maintenance, and transit police are functions that are shared by all divisions.

Each line of the systemwide calculations contains the cost of these shared items.   The systemwide printout has four major parts.   The first three are identical to the division printout. The fourth part contains budget line items that vary with changes in the annual number of passengers, such as timetables and ticket clerks.

Another difference in the systemwide printout is the type of variables (Column 1).   Most of the variables are stepwise, but the first budget line item in the first part (P.M. Peak Buses) is a direct variable.   There are two other direct variables in the third part of the printout.   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 printout also contains fixed costs.   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 two percent of the P.M. Peak Buses

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 5.5

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

| | | < - - - - - - - - - COSTS $ - - - - - - - - - -> | | | Revenue | Marg. Cost |
Division	Peak Buses	Hours	Miles	Passengers	$	$
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
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 5.6

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for the whole system (45/1987). Its share of the total fixed costs for this level-of-service measure is also two percent (45/1987*86714000).

5.7 PRINTOUT 7: FINAL SUMMARY SCREEN

The last printout (Figure 5.7) is a copy of the summary screen. The first line of the table contains the total of levels-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). This data appears at the end of the table. 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.

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	I
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			:
				:
				I
..MARGINAL COSTS	($1,068,347)	$2,790,748		$1,722,401
..FULL COSTS	($1,068,347)		$4,827,280	$3,758,933

Figure 5.7

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APPENDIX: THE FORTRAN PROGRAM

1. INTRODUCTION

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 appendix to 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).

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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 total. 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 of 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 dataset 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	Description 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.

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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 fifty
            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 ha 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   (January 1, New Years Day)
            HD(2) = 7.04
(July 4, 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

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The program can accept up to twenty 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 all 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 A-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 =  53
                        MONDAYS     =  50    (EXCLUDING HOLIDAYS)
                        TUESDAYS    =  52           "
                        WEDNESDAYS  =  52           "
                        THURSDAYS   =  50           "
                        FRIDAYS     =  51           "
                        SATURDAYS   =  52           "

                        TOTAL    = 365 DAYS
```

Figure A-4.1

Summary of Input Parameters

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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 A-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 A-4.2

List of Error Messages

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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 (3:00 p.m. - 6:00 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 comparisons.

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 A-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.

LINE	DIV	ANNUAL TOTALS BUS HOURS	BUS MILES	TOTAL PASS	TOTAL REV	PEAK BUSES	INTER-LINE	DAILY TOTALS 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	21290	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	1973935	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		165.5	2205.5	9452	4219	255
55	18	28245.5	347230.6	1488180	664275	9	1	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	5147215	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 A-4.3   Summary of Daily and Annual Totals

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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 A-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 A-4.4

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```
    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 A-4.4

(CONT.)

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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.

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 consists 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	Number of Days/Year

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
FT03FOO1	SORTED BUS-SCHEDULE FILE, SUNDAYS
FT08FOO1	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	14	700	1000	MAXIMUM LINE NUMBER
IDMAX	12	25	50	MAXIMUM DIVISION NUMBER
YEAR	14	--	2999	YEAR OF OPERATION
NYDAY	A3	--	--	FIRST THREE CHARACTERS OF NEW YEAR'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
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. <u>DOWNLOADING THE DATASET</u>

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 transferred 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 dataset into the LOTUS bus-cost program is described in Chapter 4 of this manual.