# GENERAL PLANNING CONSULTANT

# TECHNICAL MEMORANDUM 88.5.2

# LODESTAR USER'S MANUAL

Prepared for:

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

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# CHAPTER 1. LODESTAR USER'S MANUAL

LODESTAR (The Los Angeles Development and Evaluation System for Transit Alternatives and Resources) was developed by the General Planning Consultant for the Southern California Rapid Transit District as a planning and management tool. The program consists of a series of spreadsheets developed on Microsoft MULTIPLAN (Version 3.0). This manual is written for operation of the program on an IBM PC.

LODESTAR contains the most recent information available on projected SCRTD costs and revenues. Capital and operating costs are provided for heavy rail, light rail, and bus systems under consideration for construction or operation by the SCRTD. Several heavy rail and light rail lines and one busway are currently in the program, representing possible construction scenarios through the year 2010. The program includes all revenues available to the District from Federal, State, and local sources. LODESTAR produces an annual cash flow analysis by comparing projected annual costs and revenues. This analysis highlights annual deficits and surpluses and cumulative deficits and surpluses.

LODESTAR allows the user to modify basic assumptions such as project definition, project implementation schedule, economic variables (consumer price index, etc.), and various revenue projections, and to assess the impacts of these changes on cash flow. Numerous scenarios can be run quickly, providing the user with detailed information regarding the SCRTD's complex, multiyear transit development and operations program.

This manual provides an overview of LODESTAR. Each operating module is briefly described in terms of key functions and interrelationships. Supporting models which produce inputs to LODESTAR are identified. Procedures for running LODESTAR on the IBM PC are explained. Instructions assume reasonable familiarity with MULTIPLAN and the IBM PC. Finally, a number of potential management uses of LODESTAR are explained. This information includes the location of key variables and examples of scenarios that can be analyzed using this program. More detailed information on LODESTAR is included in the Technical Documentation of LODESTAR published by SCRTD in June, 1988.

# CHAPTER 2. LODESTAR: OVERVIEW OF COMPONENTS

## 2.1 STRUCTURE

LODESTAR is a cash-flow model. It consists of nine integrated spreadsheets or modules. Each module can receive input data, act upon them, and produce output to one or more subsequent modules.

A transit system cash-flow model requires a substantial amount of data to produce meaningful results. Many intermediate calculations are required. The subdivision of LODESTAR into nine modules provides an efficient way to update data and modify assumptions in a single module, while retaining the integrated nature of the full model. Each module can be modified without disturbing any other module or running the entire program.

Each module can receive data from external sources or other modules. Communication among the modules is accomplished with MULTIPLAN external functions.

Currently, nine modules are fully operational:

- Management Policy -- Module 1
- Economic/Demographic Projections -- Module 2
- Farebox Revenue Projections -- Module 3
- Project Cost Estimates -- Module 4
- Conventional Funding Projections -- Module 5
- Operating Cost Projections -- Module 7
- Capital Cost Projections -- Module 9
- Operations Cash/Flow Manager -- Module 10
- Capital Cash Flow Manager -- Module 11

The only nonfunctioning module is the Privatization Module (Module 8), while Module 6 (Bonding Module) was incorporated into Module 11.

## 2.2 SUPPORTING MODELS

LODESTAR is supported primarily by the Urban Transportation Planning System (UTPS). At present, most farebox revenue and operating cost projections are made from UTPS simulations.

Supporting models consist of data sets and schedules which must be input to LODESTAR. LODESTAR calculates cash-flow on an annual basis. Most external inputs are either totals which must be spread over time or annual data for one or two years only, which must be projected over the planning period.

The user must change or approve values for five data sets and schedules:

- o List of capital projects for implementation.
- o Implementation schedules for capital projects.
- o Construction time schedules (entered as a construction duration and implementation year) for each capital project.
- o Bus and rail operating costs for two horizon years for each defined network.
- o Bus and rail farebox revenues for two horizon years for each defined network.

A "defined network" is a set of operative capital projects with corresponding bus services. When a new capital project is implemented, a new network is defined.

Regional trip tables exist for only four years: 1985, 1990, 2000, and 2010. If a defined network is to be implemented in, for example, 1992 and be the regional network through 1996, UTPS simulations must be made for 1990 and 2000. Interpolations are made for costs and revenues for the years 1992 through 1996. In this case, 1990 and 2000 are the two "horizon" years for this defined network. The 1997 defined network may continue to exist until 2001, in which case the two horizon years for that network will also be 1990 and 2000. For such a network, interpolations are made for 1997 through 2000, with extrapolation to 2001.

Every defined network must have two horizon years, unless it exits for one year only, and that year is one of the trip-table years (i.e., 1985, 1990, 2000, or 2010). Interpolation and extrapolation are made on a straight-line basis. Currently, LODESTAR extrapolates for two years.

### 2.2.1 List of Capital Projects for Possible Implementation

The list of capital projects consists of each major capital project that the user wishes to include within the time frame under consideration (e.g., 20 years, 30 years). A capital project may be a transit line or a line segment, provided that the project can be built in operable segments.

### 2.2.2 Implementation Schedule for Capital Projects

The implementation schedule for each of the transit capital projects or project segments in the long-range plan (2.2.1 above) is also input to the model. As each new project or segment comes into operation, a new transit network is formulated and travel assignments are projected for two horizon years by the Urban Transportation Planning System (UTPS). The implementation schedule shows the year that each transit project or segment begins operating. The user may vary the schedule to develop alternative financial strategies.

### 2.2.3 Construction Time Schedule

For each of the capital projects defined in Section 2.2.1, the user provides the duration of construction. The construction schedule is open to user manipulation to compare the effects of lengthening or shortening construction schedules and the time period during which construction takes place.

### 2.2.4 Bus Operating Costs

Bus operating costs are provided through IBM mainframe computer programs that are run in conjunction with the UTPS simulations. Bus operating costs are obtained for two horizon years for each defined network. These costs and years are input to the Management Policy Module.

### 2.2.5 Rail Operating Costs

Rail operating costs are currently an external input. Metro Rail operating costs are estimated by SCRTD staff. Operating cost estimates for light rail projects and provided by the Los Angeles County Transportation Commission (LACTC).

### 2.2.6 Bus and Rail Farebox Revenue

Bus and rail farebox revenues are obtained directly from UTPS simulations and related models. These operating revenues are the principal inputs for the Farebox Revenue Module. Revenues are obtained for two horizon years from UTPS simulations. The Farebox Revenue Module interpolates or extrapolates to obtain annual farebox revenue projections for each year that a defined network is in operation.

## 2.3 MANAGEMENT POLICY (Module 1)

The Management Policy Module is the primary management framework through which broad policy scenarios are defined. It consists of all the data and information described in Section 2.2 on supporting models. All input to the Management Policy Module are external to LODESTAR.

Outputs of this module are used by the Farebox Revenue Module, Operating Cost Module, and Capital Cost Module.

## 2.4 ECONOMIC/DEMOGRAPHIC MODULE (Module 2)

The Economic/Demographic Module generates population and economic projections. Inputs to the Economic/Demographic Module are external to LODESTAR.

Demographic data consists of Los Angeles County, California, and United States population projections through the year 2000. These data are used to calculate various ratios to determine the share of various fund categories for Los Angeles County and SCRTD.

The economic portion of the module incorporates a wide range of information needed to calculate various ratios and to determine the components of conventional funding for operations and capital expenditures. Examples of information required are consumer price index projections, heavy construction cost index projections, Los Angeles and California per capita income projections, Los Angeles and California ratios of taxable sales transactions to personal income, and gasoline price projections.

Once this module is run and saved, it is not necessary to run it again in the normal operation of LODESTAR. The exceptions, of course, include updates to these basic data from current observations or better projections, or comparison of alternative future scenarios employing variations on certain projections.

Most of the output is directed to the Conventional Funding Module (Module 5). Consumer price and construction cost index projections are used in several other modules.

## 2.5 FAREBOX REVENUE MODULE (Module 3)

The results of UTPS simulations include revenue projections for the bus, heavy rail, and light rail components for each of two horizon years. Two simulations are performed in UTPS for each defined network that results from an assumed implementation schedule.

The Farebox Revenue Module projects annual farebox revenues for each defined network for each year that the network constitutes the regional transit system (the years for which annual projections are determined from the established implementation schedule in the Management Policy Module). Projections are made by straight-line interpolation or extrapolation (as appropriate) of the two horizon years from the UTPS simulations. These projections are used to provide annual revenue projections for the Operations Cash Flow Module (Module 10).

## 2.6 PROJECT COST ESTIMATE (Module 4)

The Project Cost Module provides cost estimates for various project components. Estimates for heavy rail projects are based on predetermined cost factors and measurements of rail system components. Module 4 calculates component and total costs for individual Metro Rail projects which make up the available networks. However, cost estimates of a more refined nature are used whenever they become available through SCRTD or LACTC staff.

## 2.7 CONVENTIONAL FUNDING MODULE (Module 5)

The Conventional Funding Module calculates the annual value of all funds for operating and building transit systems in Los Angeles County for the period under consideration. These include revenues from various taxes and funds designated for use in building or operating transit systems (i.e., from federal, state, county, and municipal legislation and appropriations).

In some cases, the quantity and allocation of funds are determined by direct application of formulae included in the legislation. In other cases, the quantity of funds is fixed, but the allocation of funds to several agencies is discretionary and based on government policy.

Inputs to the Conventional Funding Module include outputs of the Economic/Demographic Module.

Outputs include yearly projections of:

- Available operating revenues and subsidies.
- Sources of capital funds.

These data are used by the Operations and Capital Cash Flow Management Modules.

## 2.8 OPERATING COST MODULE (Module 7)

The results of UTPS simulations and related mainframe supporting models provide operating cost projections for the bus, heavy rail, and light rail components for each of two horizon years. These costs are currently input to the Management Policy Module.

The Operating Cost Module performs a task similar to the Farebox Revenue Module by projecting annual operating costs for each year in which a defined network represents the regional transit system. Projections are made by straight-line interpolation or extrapolation, as appropriate, from the horizon years. Application of the consumer price index provides annual operating cost projections for input to the Operations Cash Flow Management Module.

## 2.9 CAPITAL COSTS MODULE (Module 9)

The Capital Costs Module calculates the cost of constructing the networks chosen in Module 1. Total project costs calculated in

Module 4 are automatically entered into Module 9 if Module 4 is active. However, as refined cost estimates are made available, the cost data are entered directly into Module 9 and Module 4 is bypassed. Annual construction costs in 1986 dollars are determined for each year of construction activity. The escalated dollar costs per year are calculated based on the implementation date selected and the construction cost indices.

## 2.10 OPERATIONS CASH FLOW MANAGEMENT MODULE(MODULE 10)

The Operations Cash Flow Management Module considers projections of costs, revenues, grants, and subsidies accruing to SCRTD for the operation and maintenance of all the bus, heavy rail, and light rail line for which it will be responsible and calculates annual cash flows for each year in the planning period. In addition, the capital program for the bus system is presented along with a summary of the rail capital program which is input from Module 11.

The cash flow for the entire operation is balanced by adjusting the base fare. All fare box revenue estimates are calculated with a base fare of $1.00. For a given year, farebox revenues may be adjusted by changing the base fare and simultaneously applying an elasticity model to account for ridership changes resulting from the fare change.

## 2.11 CAPITAL CASH FLOW MANAGEMENT MODULE (Module 11)

The Capital Cash Flow Management Module develops a financial plan for the Los Angeles regional rail transit system. The rail corridors considered are parts of the Year 2000 portion of the proposed regional rail system and consist of the following projects: three operable segments of Metro Rail and four light rail corridors including the Long Beach-Los Angeles and Century lines.

The module considers all costs, grants and subsidies related to the construction of rail transit systems and calculates annual cash flows for each of the years in the planning period. The cash flow balancing strategy is first, to use available cash for all expenses with a reasonable balance at year's end and second, if sufficient cash is not available, to develop a bonding program which may provide sufficient funds for the proposed rail capital program.

In any event, the user may propose and investigate various management strategies to determine their impact on the financial plan.

## 2.12 SUMMARY

A brief description of each of the nine operating Modules of LODESTAR is presented in this chapter. The next chapter provides information on running LODESTAR and on the operation of MULTIPLAN.

## CHAPTER 3. RUNNING LODESTAR

### 3.1 GETTING STARTED

In order to run LODESTAR, the user needs:

- o An IBM PC with two disk drives or with a hard disk and one disk drive.
- o The MULTIPLAN boot and system disks (Version 3.0).
- o LODESTAR disks which include working versions of the nine operating modules.
- o A few blank, formatted disks.
- o MULTIPLAN User's Manual.
- o LODESTAR Technical Documentation.

Running LODESTAR is essentially the same as using MULTIPLAN. For detailed operating instructions, consult a MULTIPLAN IBM PC User's Manual (Version 3.0). Appendix A of this report consists of a set of notes designed to introduce the user to many characteristics of MULTIPLAN in a short practice session.

The mechanics of using MULTIPLAN and of running LODESTAR depend on whether the user has a hard disk or disk drives. The hard disk alternative is much easier to use. The reader is assumed to be familiar with both systems to understand the applicable instructions.

The "Getting Started" section of the MULTIPLAN User's Manual contains detailed instructions for loading MULTIPLAN onto a non-IBM PC, a PC with hard disk, or a PC with floppy disk drives. Incidentally, Version 3.0 of MULTIPLAN requires DOS Version 2.0 or higher. The DOS CONFIG.SYS file must be modified to include the line "FILES=20". Otherwise, MULTIPLAN will not load properly. If backup diskettes are needed, they should be made at this time.

The MULTIPLAN diskette package consists of three disks. One is the Installation Diskette which is used for a non-IBM PC compatible computer. Insert the diskette and follow instructions which appear on the screen.

In order to get the MULTIPLAN spreadsheet on the screen, do the following:

1. For a PC with no hard disk:

   a) Boot the system and be sure DOS Version 2.0 or higher is installed.

   b) Remove the DOS diskette from Drive A and insert the MULTIPLAN Program diskette in Drive A.

   c) Upon the A system prompt, type MP and press Return. The MULTIPLAN screen should appear.

   d) The MULTIPLAN Manual gives instructions for making a bootable MULTIPLAN diskette. However, there does not appear to be sufficient disk space for both the DOS and MULTIPLAN Program files on a single diskette.

2. For a PC with a hard disk:

   a) Boot the system, be sure DOS Version 2.0 or higher is installed and get a C prompt on the screen. Assume drive C is the hard disk and drive A is the diskette drive.

   b) Create a directory to hold the MULTIPLAN 3.0 file. Type MD/MP and press Return. A directory called MP is created.

   c) At the C prompt, type CD\MP and press Return. This changes to the MP directory.

   d) Insert the MULTIPLAN Program diskette in drive A and type COPY A:*.* after the prompt and press Return.

   e) At the system prompt, remove the MULTIPLAN Program disk, insert the template diskette, and repeat the COPY command.

   f) At the system prompt, type MP and press Return. The MULTIPLAN screen should appear. Once MULTIPLAN is resident on the hard disk, it is loaded as follows:

- On the C prompt, type CD\MP and press Return.

- On the prompt, type MP and press Return.

When the MULTIPLAN screen appears, the next step is to specify the default drive or subdirectory for reading and saving files or modules in the case of LODESTAR. For a computer with no hard disk, do the following:

1) Press T for Transfer;

2) Press O for Options;

3) Press the tab key to access setup;

4) Type B: to indicate the B drive; and

5) Press Return to the menu.

Normally, one leaves the MULTIPLAN system disk in drive A so the user can access the "Help" files. For a computer with a hard disk, do the following:

1) Create a MULTIPLAN subdirectory.

2) Within the MULTIPLAN directory, create a subdirectory called LSFY88 for LODESTAR Fiscal Year 88 or any convenient name. On the C prompt, type MD\MP\LSFY88 and press Return to create this subdirectory.

3) Press T for Transfer.

4) Press O for Options.

5) Press the tab key to access setup.

6) Type C:\MP\LSFY88 and press Return.

when the MULTIPLAN screen appears, the next step is to load the cash flow model.

## 3.2 LOADING THE CASH FLOW MODEL

LODESTAR consists of a series of spreadsheets linked together in sequence. The sequence is important when running LODESTAR. Spreadsheets are linked so that data entered in one module is used to recalculate the data in subsequent modules. For recalculation to occur, it is necessary to load the module in which the re-

calculation is to take place. For example, farebox revenue is entered into Module 1 (Management Policy) for two horizon years. Module 3 (Farebox Revenue) calculates the annual amounts of farebox revenue from the two horizon years provided to Module 1. Therefore, if a change is made in the farebox revenue inputs for any defined network in Module 1, Module 3 must be reloaded for the annual revenue to be calculated.
Initially, the appropriate LODESTAR modules are on diskettes. Load the disk in the default drive, generally B. Do the following to load Module 1:

1) Press T for Transfer;

2) Press L for Load;

3) Type MODULE1 and press Return;

4) As an alternative to step 3), press the right directional arrow. The screen will list all files on the disk. Simply move the cursor to MODULE1 and press Return.

For a computer with a hard disk, the user can follow the procedure outlined above or can load all the files in a subdirectory such as LSFY88. On the C prompt and with the disk in the A drive, type:

```
COPY A:\*.* C:\MP\LSFY88
```

and press RETURN. Alternately, individual files may be copied to the hard disk.

The Management Policy module is now displayed on the MULTIPLAN worksheet. The cell pointer is highlighted and can be moved to any cell by using the appropriate direction keys. Only a portion of the worksheet is visible. The remainder can be displayed by scrolling the worksheet, using either the direction keys or the GO TO command.

Changes in data can be made by moving the cursor to the appropriate cell and following this procedure:

- Press A for Alpha if the cell contains text or nonnumeric data;

- Press V for Value if the cell contains numeric data which will be involved in algebraic manipulation;

- Type in the new data; and

- Press Return.

Many cells in MULTIPLAN contain a numeric value calculated by a formula associated with the cell. The formula may be modified by pressing E for Edit and following instructions. The Help file provides much additional information and may be accessed by pressing ? or H if the main menu is on display. For additional information on changes, refer to Appendix A in this report or to the MULTIPLAN User's Manual.

After all changes to the module have been made, the revised worksheet must be saved to permit subsequent modules to access the revisions. The procedure follows:

1) Press T for transfer.

2) Press S for save.

3) Press RETURN if the file name will not be changed.

4) Press Y because the old file must be overwritten with the revised file.

This saves the recalculated Module 1 on the working copy of the Cash-Flow Module. If Drive B still contains a master copy (write-protected), MULTIPLAN will tell the user that the revised spreadsheet cannot be saved on the write-protected disk. A working copy disk must be used. The above procedure applies to hard disks as well. If the user wishes to store the revised file with a new name, press T and S and type in the new name such as MODULE1A. Name lengths are limited to 8 characters. If the user wishes to store the revised file somewhere other than the default drive, the user must specify the default drive and the file name. For example, to store the revised file in the subdirectory, press T and S and type:

C:\MP\LSFY88\MODULE1A

and press Return.

As each subsequent module is loaded, MULTIPLAN reads all linked input modules. Data requested by the module being loaded are entered automatically from other saved modules and required calculations are made. MULTIPLAN does not permit the user to change data input from other modules or worksheets. Any data changes must be made in the originating modules so that the output files can be recalculated. Any data items not read from other modules can be changed by the user.

The file names for the modules are:

| | | |
|---|---|---|
| o | MODULE1 | Management Policy |
| o | MODULE2 | Economic/Demographic |
| o | MODULE3 | Farebox Revenue |
| o | MODULE4 | Project Cost Estimate |

| | | |
|---|---|---|
| o | MODULE5 | Conventional Funding |
| o | MODULE7 | Operating Costs |
| o | MODULE9 | Capital Cost Projections |
| o | MODULE10 | Operations Cash Flow Management |
| o | MODULE11 | Capital Cash Flow Management |

In general, the modules must be accessed in numerical sequence. The only exception is that Module 11, the Capital Cash Flow Manager, must precede Module 10, the Operations Cash Flow Manager. Initially, after entering changes in MODULE1, the user loads and saves each of the other modules in strict numerical sequence, even if no changes are made to the direct inputs of the subsequent modules. The sequential loading and saving of each module allows LODESTAR to recalculate all appropriate values for input to MODULE10 and MODULE11, the Cash-Flow Managers.

## 3.3 PRINTING A MODULE

Any module that has been loaded, while it remains in the workspace, may be printed as follows:

- o Press for Print; and
- o Press for Printer.

It is necessary to use a 120-column printer. If changes have been made in the module, the file should be saved before printing, unless the user does not wish to save the changes or access any subsequent modules.

Immediately after pressing P for Print, the user may press O for Options and adjust such items as the numbers of the rows and columns to be printed and whether to print formulas, row numbers and column numbers. The user may press M for Margins to adjust the left and top margins, the print length and the page length.

## 3.4 MAKING SELECTIVE CHANGES IN INPUTS

After proceeding through the steps in Sections 3.2 and 3.3, the user may wish to return to one of the earlier modules and make selected changes in input values. For example, the implementation date of one transit capital project or project segment may be changed. In that event, it is not necessary to reload and save each of the modules.

Table 3-1 shows some values that the user may change and the modules which must be reloaded and saved, if that change alone is made. The table does not specify other calculations that would be made outside the Cash-Flow Model, such as rerunning UTPS simulations. However, many of these changes in input values require other recalculations to be made outside the Cash-Flow Model.

In some instances, it may be desirable to have alternate data sets stored in the subdirectory accessed by MULTIPLAN rather than make several changes in the module each time it is run. For example, there may be project cost estimates for each of several alternative construction programs. Each individual data set would be stored under a unique file name such as MODULE4A, MODULE4B, etc. However, LODESTAR runs by accessing MODULE 4.

In this case, use the Transfer-Load sequence to load one of the alternative data sets, for example, MODULE4H. Then use the Transfer-Save sequence to save MODULE4H as MODULE4. Now run LODESTAR with this new date set. MODULE4H remains available for later use or modification as required in subsequent LODESTAR runs. The user must be certain the correct data set is available for LODESTAR access each time an analysis run is performed.

TABLE 3.1

MODULES THAT MUST BE RELOADED AFTER
SPECIFIC USER CHANGES

| Module | Character of Change | Modules to Reload and Save |
| --- | --- | --- |
| 1 | o Defined Networks for analysis<br>o New or deleted projects<br>o Implementation Schedule | 1, 3, 7, 9, 11, 10 |
| 1 | o Bus or rail operating costs only | 1, 7, 10 |
| 1 | o Farebox Revenue only | 1, 3, 5, 10 |
| 2 | o Other than CPI or HCI | 2, 5, 10 |
| 2 | o Any including CPI or HCI | 2, 3, 5, 7, 9, 10, 11 |
| 3 | o Any | 3, 5, 10 |
| 4 | o Any | 4, 9, 11, 10 |
| 5 | o Any | 5, 11, 10 |
| 7 | o Other than bus replacement | 7, 10 |
| 7 | o Any including bus replacements | 7, 9, 10 |
| 9 | o Any | 9, 11, 10 |
| 11 | o Any | 11, 10 |
| 10 | o Any | 10 |

Notes: 1. When running Module 11 (the Capital Cash-Flow Manager), only Module 1, 2 (CPI or HCI), 4 (if active), and 9 may have an impact on Module 11 calculations.

2. When running Module 10 (the Operations Cash-Flow Manager), changes to Modules 1, 2, 3, 5, 7, 9 and 11 may have an impact on Module 10 calculations.

# CHAPTER 4. MANAGEMENT USES OF LODESTAR

Some likely uses for LODESTAR are presented in this section. Changes will most frequently be made in the information in the Management Policy Module, which specifies project implementation schedules. Changes also may be made in key data items in other modules.

## 4.1 MANAGEMENT POLICY INPUTS

Policy inputs regarding project implementation are made in the Management Policy module. Changes in implementation dates and durations allow the user to review the cash flow implications of speeding up or delaying implementation of individual projects, or of shortening or lengthening the construction program.

As shown in Figure 4.1, the Management Policy Module includes lists of heavy rail, light rail, and busway projects. Within the three groups, individual projects are listed in chronological order of implementation. If changes are made in this chronology, new UTPS travel simulations are required to generate appropriate operating cost and farebox data and these data input to this Module. While this requirement has significant implications from a time and cost standpoint, note that this data is needed only to run the Operations Cash-Flow Program. The Capital Cash-Flow Program runs without this data. Thus, the data will be calculated only for those scenarios which are feasible from a capital standpoint and if required by SCRTD management.

Policy variables that may be modified include the scheduled implementation date (the year the project system will be operational) and the duration of the implementation program (DUR). The range of implementation dates is limited by the dates for which travel simulations are available (see SIMULATION DATES in the module). Selected implementation dates must fall between the years for which simulations are available (i.e., no earlier than two years before the first simulation date or no later than two years after the date of the later simulation). For example, simulations are available for MOS-2 for the years 1990 and 2000. Therefore, an implementation date between 1988 and 2002 inclusive may be selected. The limitation on the length of duration for implementation of a project is 8 years. These or any other variables in any module are changed by moving the cursor to the cell containing the data to be changed, typing in the new data and pressing the return key. If the change is to be retained for future use, the user must save the file on a blank disk or on the hard disk.

**Figure 4.1 The Management Policy Module**

MODULE1: MANAGEMENT POLICY ALIGNMENT 4 ; MOS-2B

THE FOLLOWING NETWORKS ARE AVAILABLE FOR CASH FLOW ANALYSIS

| NETWORK I.D. | NETWORK DESCRIPTION | SIMULATION DATES SIM-1 | SIMULATION DATES SIM-2 | OPERATING COSTS (DEC 85 DOLLARS) BUS SIM-1 | BUS SIM-2 | METRO SIM-1 | METRO SIM-2 | LRT SIM-1 | LRT SIM-2 | REVENUE PROJECTIONS (DEC 85 DOLLARS) BUS SIM-1 | BUS SIM-2 | METRO SIM-1 | METRO SIM-2 | LRT SIM-1 | LRT SIM-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ALL BUS SYSTEM | 1985 | 1990 | 504.50 | 517.31 | 0.00 | 0.00 | 0.00 | 0.00 | 218.94 | 232.71 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | LB-LA | 1990 | 2000 | 502.91 | 508.99 | 0.00 | 0.00 | 14.40 | 20.05 | 232.71 | 270.07 | 0.00 | 0.00 | 11.50 | 12.72 |
| 3 | LB-LA MOS-1 | 1990 | 2000 | 491.15 | 524.39 | 12.03 | 15.40 | 14.40 | 20.05 | 262.77 | 285.73 | 3.57 | 4.34 | 11.50 | 12.72 |
| 4 | LB-LA MOS-1 CENTEX | 1990 | 2000 | 504.30 | 527.58 | 12.33 | 15.40 | 15.46 | 30.94 | 268.41 | 287.59 | 3.50 | 4.24 | 17.34 | 18.77 |
| 5 | LB-LA MOS-1 MOS-2 | 1990 | 2000 | 473.04 | 529.45 | 24.14 | 30.90 | 14.40 | 20.05 | 256.41 | 327.38 | 38.43 | 52.55 | 14.26 | 15.77 |
| 6 | LB-LA MOS-1 CENTEX MOS-2 | 1990 | 2000 | 450.53 | 518.56 | 24.14 | 30.90 | 15.46 | 30.94 | 256.41 | 327.38 | 38.43 | 52.55 | 18.36 | 23.27 |
| 7 | | 2001 | 2010 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8 | | 2001 | 2010 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 | 1990 | 2000 | 446.27 | 514.61 | 31.40 | 40.20 | 15.46 | 30.94 | 231.20 | 295.37 | 48.90 | 65.67 | 18.36 | 23.27 |
| 10 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 | 1990 | 2000 | 446.27 | 514.61 | 31.40 | 40.20 | 15.46 | 30.94 | 231.20 | 295.37 | 48.90 | 65.67 | 18.36 | 23.27 |
| 11 | LB-LA MOS-1 CENTEX MOS-2 LRTC1 | 1990 | 2000 | 445.70 | 511.88 | 24.14 | 30.90 | 22.29 | 42.97 | 250.88 | 320.27 | 38.43 | 52.55 | 23.89 | 30.38 |
| 12 | LB-LA MOS-1 CENTEX MOS-2 LRTC2 | 1990 | 2000 | 446.70 | 511.38 | 24.14 | 30.90 | 22.29 | 42.97 | 250.88 | 320.27 | 38.43 | 52.55 | 23.89 | 30.38 |
| 13 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 | 1990 | 2000 | 439.44 | 502.58 | 31.40 | 40.20 | 22.29 | 42.97 | 225.57 | 298.36 | 48.90 | 65.57 | 23.89 | 30.38 |
| 14 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1 | 1990 | 2000 | 439.44 | 502.58 | 31.40 | 40.20 | 22.29 | 42.97 | 225.57 | 298.36 | 48.90 | 65.67 | 23.99 | 30.38 |
| 15 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 LRTC2 | 1990 | 2000 | 433.98 | 492.95 | 31.40 | 40.20 | 27.75 | 52.50 | 220.14 | 291.75 | 48.90 | 65.67 | 29.42 | 37.49 |
| 16 | LB-LA MOS-1 CENTEX MOS-2 MOS-3 MOS-4 LRTC1 LRTC2 | 1990 | 2000 | 433.98 | 492.95 | 31.40 | 40.20 | 27.75 | 52.50 | 220.14 | 291.75 | 48.90 | 65.57 | 29.42 | 37.49 |

MGMT POLICY ALIGN 4 MOS-2B
THE FOLLOWING NETWORKS HAVE BEEN IDENTIFIED FOR USE IN THE CURRENT ANALYSIS

| NW ID | SCHED IMPLEMENTATION | NETWORK DESCRIPTION | SIMULATION DATES SIM-1 | SIMULATION DATES SIM-2 | OPERATING COSTS ($84) BUS SIM-1 | BUS SIM-2 | METRO SIM-1 | METRO SIM-2 | LRT SIM-1 | LRT SIM-2 | REVENUE PROJECTIONS ($84) BUS SIM-1 | BUS SIM-2 | METRO SIM-1 | METRO SIM-2 | LRT SIM-1 | LRT SIM-2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1984 FISCAL YEAR | ALL BUS SYSTEM | 1985 | 1990 | 504.50 | 517.31 | 0.00 | 0.00 | 0.00 | 0.00 | 218.34 | 232.71 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 1991 FISCAL YEAR | LB-LA | 1990 | 2000 | 502.91 | 508.99 | 0.00 | 0.00 | 14.40 | 20.05 | 232.71 | 270.07 | 0.00 | 0.00 | 11.50 | 12.72 |
| 3 | 1993 FISCAL YEAR | LB-LA MOS-1 | 1990 | 2000 | 491.15 | 524.39 | 12.03 | 15.40 | 14.40 | 20.05 | 262.77 | 285.73 | 3.57 | 4.34 | 11.50 | 12.72 |
| 4 | 1993 FISCAL YEAR | LB-LA MOS-1 CENTEX | 1990 | 2000 | 504.30 | 527.58 | 12.03 | 15.40 | 15.46 | 30.94 | 268.41 | 287.59 | 3.50 | 4.24 | 17.34 | 18.77 |
| 6 | 1996 FISCAL YEAR | LB-LA MOS-1 CENTEX MOS-2 | 1990 | 2000 | 450.53 | 518.56 | 24.14 | 30.30 | 15.46 | 30.34 | 256.41 | 327.38 | 38.43 | 52.55 | 18.36 | 23.27 |
| 11 | 1998 FISCAL YEAR | LB-LA MOS-1 CENTEX MOS-2 LRTC1 | 1990 | 2000 | 445.70 | 511.88 | 24.14 | 30.90 | 22.29 | 42.97 | 250.38 | 320.27 | 38.43 | 52.55 | 23.89 | 30.38 |
| 13 | 2000 FISCAL YEAR | LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 | 1990 | 2000 | 439.44 | 502.58 | 31.40 | 40.20 | 22.29 | 42.97 | 225.57 | 298.36 | 48.90 | 65.67 | 23.89 | 30.38 |
| 15 | 2000 FISCAL YEAR | LB-LA MOS-1 CENTEX MOS-2 MOS-3 LRTC1 LRTC2 | 1990 | 2000 | 433.98 | 492.95 | 31.40 | 40.20 | 27.75 | 52.50 | 220.14 | 291.75 | 48.90 | 65.67 | 29.42 | 37.49 |

THE NETWORKS IDENTIFIED ABOVE FOR ANALYSIS DEFINE IMPLEMENTATION DATES FOR THE FOLLOWING SPECIFIED TRANSPORTATION IMPROVEMENTS.

| HEAVY RAIL DESC | NETWORK DESIGNATION | IMPLEMENTATION REVENUE SERVICE | IMPLEMENTATION CONSTR COMPLT | DUR | LIGHT RAIL DESC | NETWORK DESIGNATION | IMPLEMENTATION REVENUE SERVICE | IMPLEMENTATION CONSTR COMPLT | DUR | BUSWAY DESC | NETWORK DESIGNATION | IMPLEMENTATION REVENUE SERVICE | IMPLEMENTATION CONSTR COMPLT | DUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MOS-1 | 3 | 1993 | 1992 | 7 | LB-LA | 2 | 1991 | 1991 | 6 | HARBOR | - | - | - | 3 |
| MOS-2 | 6 | 1996 | 1995 | 8 | CENTURY EXT. | 4 | 1993 | 1993 | 6 | | | | | |
| MOS-3 | 13 | 2000 | 1999 | 5 | LRTC1 | 11 | 1998 | 1996 | 5 | | | | | |
| MOS-4 | - | - | - | 5 | LRTC3 | - | - | - | 4 | | | | | |
| EAST LA METRO | - | - | - | 5 | LRTC4 | - | - | - | 3 | | | | | |
| NORWALK METRO | - | - | - | 5 | LRTC2 | 15 | 2000 | 2000 | 5 | | | | | |
| SANTA MONICA | - | - | - | 5 | LRTC5 | - | - | - | 3 | | | | | |

FISCAL YEAR

| NETWORK I.D. | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NETWORK 1 | I | + | + | + | + | I | + | + | | | | | | | | | | | | | | | | | | |
| NETWORK 2 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 3 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 4 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 5 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 11 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 13 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |
| NETWORK 15 | | | | + | + | I | + | + | + | + | + | + | + | + | + | I | + | + | | | | | | | | |

The graphic at the bottom of the Management Policy module is a visual representation of project chronology and implementation dates. It shows whether acceptable parameters have been exceeded. Dashed lines must fall within the guidelines discussed above for scheduled implementation. The 'X's in the graphic indicate horizon years, for which trip tables exist and UTPS simulations can be made.

## 4.2 ECONOMIC/DEMOGRAPHIC PROJECTIONS

Economic and demographic projections are contained in the second module (Figure 4.2). The left-most entry on each row indicates the source of the data in that row. This module includes base data used by other modules for calculating available revenues and inflated costs and revenues. Generally, these data should not be modified, unless new regional forecasts have been adopted.

A user can, however, review the implications of changes to certain basic assumptions in this Module. For example, a user can review the effects on future year costs and revenues of changes in the Consumer Price Index or the Construction Cost Index. The current values can be changed by moving the cursor to the value, typing in the new figure, and pressing the return key. Such changes should be saved on a new diskette or later restored to the original values. (See Section 3.4 for additional details.) Gasoline prices or other data can be changed as well. However, minor modifications may have relatively little impact on revenues available to the SCRTD.

## 4.3 CAPITAL COSTS

The Capital Costs module distributes rail capital costs over the duration specified. Costs are spread using a construction cost distribution curve based on historical data. The user can modify the curve if new information is available. For example, a project with a three year duration is assumed to incur obligations of 35.1%, 43.9%, and 21% in each of the three years, respectively. The user can change these numbers to reflect new data on expenditures (rather than obligations), or on yearly percentages. As an example, when the design of a transit facility nears various levels of completion, more detailed and more accurate cost estimates are made. The project is broken down into contacts, each of which has a certain start time, duration, and cost estimate. Establishment of a construction management schedule enables a detailed year by year cost distribution to be established for the project. When this data is available, it should be input directly to the Capital Cost Module (Module 9) rather than calculated by a generalized cost distribution curve.

**Figure 4.2 Economic/Demographic Module**

MODULE 2 ECONOMIC/DEMOGRAPHIC PROJECTIONS

| | FISCAL YEAR | | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ***INPUT*** | | | | | | | | | | | | | | | | | | |
| | POPULATION | | | | | | | | | | | | | | | | | | |
| --->SCAG | L.A. CO. POPULATION, CY | 000s | 7975 | 8137 | 8332 | 8497 | 8592 | 8665 | 8736 | 8805 | 8874 | 8942 | 9008 | 9073 | 9137 | 9201 | 9262 | 9323 | 9383 |
| --->SCAG | L.A. CO. POPULATION, FY | 000s | 7921 | 8028 | 8246 | 8413 | 8556 | 8629 | 8700 | 8771 | 8840 | 8908 | 8975 | 9041 | 9106 | 9169 | 9232 | 9293 | 9353 |
| --->SCAG | L.A. CO. POPULATION GROWTH RATE | % | | 1.35 | 2.72 | 2.03 | 1.64 | 0.85 | 0.83 | 0.81 | 0.79 | 0.77 | 0.75 | 0.73 | 0.72 | 0.70 | 0.68 | 0.66 | 0.65 |
| --->DOF | CA. POPULATION, CY | 000s | 25819 | 26394 | 27038 | 27704 | 28235 | 28573 | 29100 | 29526 | 29943 | 30370 | 30789 | 31202 | 31612 | 32018 | 32420 | 32817 | 33214 |
| --->DOF | CA. POPULATION, FY | 000s | 25556 | 26079 | 26693 | 27388 | 28019 | 28453 | 28886 | 29313 | 29739 | 30161 | 30532 | 30996 | 31408 | 31816 | 32220 | 32529 | 33015 |
| --->DOF | CA. POPULATION GROWTH RATE | % | | 2.05 | 2.34 | 2.62 | 2.30 | 1.55 | 1.52 | 1.48 | 1.45 | 1.42 | 1.39 | 1.35 | 1.33 | 1.30 | 1.27 | 1.24 | 1.21 |
| --->USDOC | U.S. POPULATION, CY | 000s | 236439 | 238631 | 240822 | 242993 | 245105 | 247197 | 249256 | 251290 | 253271 | 255229 | 257150 | 259037 | 260930 | 262708 | 264432 | 266241 | 267955 |
| --->USDOC | U.S. POPULATION, FY | 000s | 234313 | 237523 | 239727 | 241391 | 244043 | 246151 | 248227 | 250253 | 252276 | 254250 | 256139 | 258034 | 259964 | 261799 | 263600 | 265367 | 267098 |
| --->USDOC | U.S. POPULATION GROWTH RATE | % | | 0.94 | 0.92 | 0.90 | 0.87 | 0.85 | 0.83 | 0.81 | 0.79 | 0.77 | 0.75 | 0.73 | 0.72 | 0.70 | 0.68 | 0.66 | 0.64 |
| --->DOF | OTHER PROP 5 CO. POPULATION, FY | 000s | 9411 | 9725 | 9943 | 10093 | 10234 | 10375 | 10520 | 10660 | 10799 | 10935 | 11072 | 11205 | 11337 | 11467 | 11595 | 11721 | 11845 |
| --->DOF | OTHER PROP 5 CO. POP GRWTH RATE | % | | 3.37 | 2.21 | 1.47 | 1.44 | 1.40 | 1.37 | 1.33 | 1.30 | 1.27 | 1.24 | 1.21 | 1.18 | 1.15 | 1.12 | 1.09 | 1.05 |
| | PRICE INDICES | | | | | | | | | | | | | | | | | | |
| --->CAL | U.S. CPI-U | FY1986=100 | 91.92 | 96.10 | 100.00 | 103.56 | 107.71 | 112.01 | 116.49 | 121.15 | 126.00 | 131.04 | 136.28 | 141.73 | 147.40 | 153.30 | 159.43 | 165.81 | 172.44 |
| --->CAL | U.S. CPI-U GROWTH RATE | % | | 4.5 | 4.1 | 3.5 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| --->CAL | U.S. CPI-U | 1967=100 | 299.30 | 312.93 | 325.63 | 337.20 | 350.69 | 364.72 | 379.30 | 394.48 | 410.26 | 426.67 | 443.73 | 461.48 | 479.94 | 499.14 | 519.10 | 539.87 | 561.46 |
| --->CAL | CA. HWY CONSTRUCTION INDEX | FY1986=100 | 95.47 | 99.30 | 100.00 | 104.00 | 108.16 | 112.49 | 116.99 | 121.67 | 126.53 | 131.59 | 136.86 | 142.33 | 148.02 | 153.95 | 160.10 | 166.51 | 173.17 |
| --->CAL | CA. HCI GROWTH RATE | % | 3.37 | 3.55 | 0.70 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 | 4.00 |
| | REAL PERSONAL INCOME/CAPITA | | | | | | | | | | | | | | | | | | |
| --->SCAG | L.A. REAL PERSNL INCOME/CAPITA | $,1967 | 4764 | 4810 | 4955 | 5002 | 5092 | 5189 | 5298 | 5420 | 5620 | 5710 | 5801 | 5894 | 5989 | 6084 | 6182 | 6281 | 6381 |
| --->SCAG | L.A. REAL PERSNL INCM/CAP GRWTH | % | | 2.10% | 2.00% | 3.00% | 1.90% | 1.30% | 2.10% | 2.30% | 3.70% | 1.60% | 1.60% | 1.60% | 1.60% | 1.60% | 1.60% | 1.60% | 1.60% |
| --->CAL | CA. REAL PERSNL INCOME/CAPITA | $,1967 | 4463 | 4505 | 4550 | 4595 | 4582 | 4776 | 4881 | 4999 | 5188 | 5276 | 5366 | 5457 | 5550 | 5645 | 5740 | 5838 | 5937 |
| --->CAL | CA. REAL PERSNL INCM/CAP GRWTH | % | | 1.00% | 1.00% | 1.00% | 1.30% | 2.00% | 2.20% | 2.40% | 3.80% | 1.70% | 1.70% | 1.70% | 1.70% | 1.70% | 1.70% | 1.70% | 1.70% |
| --->CAL | CA. PERSNL INCOME/CAP GRWTH | % | | 5.59% | 5.10% | 4.60% | 5.30% | 6.08% | 6.23% | 6.50% | 7.95% | 5.77% | 5.77% | 5.77% | 5.77% | 5.77% | 5.77% | 5.77% | 5.77% |
| | TAXABLE SALES COEFFICIENTS | | | | | | | | | | | | | | | | | | |
| --->SCAG | L.A. TXBL SALES/PERSNL INCM | | | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 | 0.5259 |
| --->RTD | L.A. TS/PI (SAFE ESTIMATE) | | | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 | 0.4994 |
| --->SCAG | CA. TXBL SALES/PERSNL INCM | | | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 | 0.5435 |
| | | | | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 | 0.5170 |
| | GASOLINE PRICES | | | | | | | | | | | | | | | | | | |
| --->CAL | CA. GASOLINE REAL PRICE | $/GAL,FY67 | 0.38 | 0.36 | 0.32 | 0.27 | 0.28 | 0.27 | 0.27 | 0.27 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 |
| --->CAL | CA. GASOLINE PRICE | $/GAL,I | 1.14 | 1.13 | 1.04 | 0.92 | 0.97 | 1.00 | 1.04 | 1.09 | 1.13 | 1.18 | 1.23 | 1.28 | 1.33 | 1.38 | 1.43 | 1.49 | 1.55 |
| --->CAL | CA. GAS REAL PRICE GRWTH RATE | % | | -5.94 | -11.42 | -14.15 | 1.36 | -0.57 | -0.49 | 0.51 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | VEHICLE MILES TRAVELED | | | | | | | | | | | | | | | | | | |
| --->CAL | CA. LDV VMT/Capita Index | FY84=100 | 100 | 100.70 | 101.40 | 102.11 | 103.47 | 104.92 | 106.54 | 108.33 | 111.21 | 112.53 | 113.87 | 115.23 | 116.60 | 117.98 | 119.39 | 120.81 | 122.25 |
| --->CAL | CA. LDV VMT/CAPITA GRWTH RATE | % | | 0.70% | 0.70% | 0.70% | 1.33% | 1.40% | 1.54% | 1.68% | 2.66% | 1.19% | 1.19% | 1.19% | 1.19% | 1.19% | 1.19% | 1.19% | 1.19% |
| --->CAL | CA. Commercial Fleet Index | FY85=100 | 96.5 | 100 | 102.2 | 104 | 105.3 | 108.13 | 109.93 | 111.70 | 113.32 | 114.93 | 116.53 | 118.11 | 119.68 | 121.24 | 122.78 | 124.30 | 125.80 |
| --->SCAG | CA. COM'L FLT INDEX GRWTH RATE | % | | 3.52% | 2.20% | 1.76% | 1.33% | 2.38% | 1.67% | 1.64% | 1.45% | 1.42% | 1.39% | 1.36% | 1.33% | 1.30% | 1.27% | 1.24% | 1.21% |
| | FUEL DEMAND | | | | | | | | | | | | | | | | | | |
| --->CAL | CA. NEW LDV FUEL EFFICIENCY | MPG | 23.13 | 22.29 | 19.75 | 16.95 | 17.13 | 17.04 | 16.95 | 17.04 | 17.14 | 17.14 | 17.14 | 17.14 | 17.14 | 17.14 | 17.14 | 17.14 | 17.14 |
| --->CAL | CA. NEW LDV FUEL EFFCY GR RATE | % | | -5.94 | -11.42 | -14.15 | 1.36 | -0.57 | -0.49 | 0.51 | 0.59 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| --->CEC | CA. AVG LDV FUEL EFFICIENCY | MPG | 16.40 | 16.75 | 16.96 | 16.96 | 16.97 | 16.99 | 16.98 | 16.98 | 16.99 | 17.01 | 17.02 | 17.03 | 17.03 | 17.04 | 17.05 | 17.06 | 17.06 |
| --->CEC | CA. AVG LDV FUEL EFFCY GR RATE | % | | 2.16 | 1.23 | 0.00 | 0.08 | 0.03 | -0.01 | 0.03 | 0.07 | 0.07 | 0.06 | 0.06 | 0.05 | 0.05 | 0.04 | 0.04 | 0.04 |
| --->CAL | CA. LDV FUEL DEMAND | MIL GALS | 10920 | 11220 | 11520 | 12080 | 12313 | 12423 | 12553 | 12660 | 12770 | 12880 | 12990 | 13100 | 13210 | 13320 | 13430 | 13543 | 13650 |
| --->CAL | CA. TRUCK FUEL DEMAND | MIL GALS | 1839 | 1904 | 1946 | 1980 | 2015 | 2058 | 2092 | 2126 | 2157 | 2188 | 2218 | 2249 | 2278 | 2308 | 2337 | 2366 | 2395 |
| | U.S. GASOLINE ADJUSTMENT FACTOR | | | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| | U.S. DIESEL ADJUSTMENT FACTOR | | | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | OPERATING REVENUES | | | | | | | | | | | | | | | | | | |
| --->SCAG | CA. OPERATING REVENUES | $MIL,I | 774.9 | 826.7 | 880.4 | 935.6 | 995.5 | 1051.4 | 1110.0 | 1171.5 | 1236.0 | 1303.7 | 1374.7 | 1449.2 | 1527.2 | 1608.9 | 1694.5 | 1784.2 | 1879.0 |
| --->SCAG | CA. REAL OPERATING REVENUES | % | | 5.68 | 6.49 | 6.29 | 6.40 | 5.61 | 5.58 | 5.54 | 5.51 | 5.48 | 5.45 | 5.41 | 5.38 | 5.35 | 5.32 | 5.29 | 5.26 |
| | ***OUTPUT*** | | | | | | | | | | | | | | | | | | |
| | L.A. CO TXBL TRANS (SAFE EST) | $BIL,I | | 61 | 66 | 69 | 75 | 80 | 86 | 92 | 100 | 107 | 114 | 121 | 129 | 137 | 146 | 156 | 165 |
| | CA. TAXABLE TRANSACTIONS | $BIL,I | | 200 | 216 | 225 | 233 | 257 | 271 | 293 | 319 | 345 | 371 | 398 | 425 | 457 | 489 | 524 | 561 |
| | SCRTD/L.A.CO SUBSIDY SHARE | | | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 | 0.864375 |
| | CA. GASOLINE SALES | MIL GALS | 10920 | 11220 | 11520 | 12080 | 12310 | 12423 | 12553 | 12660 | 12770 | 12880 | 12990 | 13100 | 13210 | 13320 | 13430 | 13540 | 13650 |
| | CA. DIESEL SALES | MIL GALS | 1839 | 1904 | 1946 | 1980 | 2015 | 2058 | 2092 | 2126 | 2157 | 2188 | 2218 | 2249 | 2278 | 2308 | 2337 | 2366 | 2395 |
| | U.S. GASOLINE SALES | MIL GALS | | 100145 | 101403 | 104561 | 105074 | 105297 | 105630 | 105925 | 106164 | 106405 | 106650 | 106899 | 107152 | 107411 | 107676 | 107946 | 108224 |
| | U.S. DIESEL SALES | MIL GALS | | 22540 | 22720 | 22733 | 22827 | 23144 | 23373 | 23692 | 23791 | 23977 | 24160 | 24340 | 24516 | 24699 | 24859 | 25025 | 25189 |
| | CA. GASOLINE PRICE | $,I | | 1.13 | 1.04 | 0.92 | 0.97 | 1.00 | 1.04 | 1.08 | 1.13 | 1.18 | 1.23 | 1.28 | 1.33 | 1.38 | 1.43 | 1.49 | 1.55 |
| | PROP 5 CO POP/CA POP COEFF | | | 0.6850 | 0.6843 | 0.6733 | 0.6713 | 0.6692 | 0.6666 | 0.6640 | 0.6615 | 0.6591 | 0.6566 | 0.6542 | 0.6519 | 0.6496 | 0.6473 | 0.6451 | 0.6433 |
| | CA. OPERATING REVENUES | $MIL,I | | 827 | 880 | 935 | 995 | 1051 | 1110 | 1172 | 1236 | 1304 | 1375 | 1449 | 1527 | 1609 | 1695 | 1784 | 1879 |
| | L.A.CO POP/CA.POP COEFF | | | 0.3078 | 0.3090 | 0.3074 | 0.3054 | 0.3033 | 0.3012 | 0.2992 | 0.2973 | 0.2954 | 0.2935 | 0.2917 | 0.2899 | 0.2882 | 0.2865 | 0.2849 | 0.2833 |
| | LA CO POP/OTHR PROP5 CO POP COEF | | | 0.4521 | 0.4559 | 0.4569 | 0.4554 | 0.4559 | 0.4537 | 0.4524 | 0.4511 | 0.4498 | 0.4486 | 0.4474 | 0.4463 | 0.4452 | 0.4441 | 0.4430 | 0.4420 |
| | TP&D SALES TAX CAP GROWTH RATE | % | | 5.68 | 6.49 | 6.29 | 6.40 | 5.61 | 5.58 | 5.54 | 5.51 | 5.48 | 5.45 | 5.41 | 5.38 | 5.35 | 5.32 | 5.29 | 5.25 |
| | SCRTD/LA CO-PROP A SHARE | | | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 | 0.85631 |

## 4.4 CAPITAL CASH FLOW MANAGER

The Capital Cash Flow Manager (Figure 4.3) provides a summary of capital costs for Metro Rail and the light rail corridors and for all sources of capital construction funds accruing to SCRTD and LACTC for regional rail construction. Changes in construction time tables, capital costs, escalation rates, and other factors related to costs are made in other modules and input to Module 11 when it is loaded.

Changes in Module 11 are related to the amount of funds available from a particular source and the timing of the receipt of the funds. Rail construction funds are available from several sources: UMTA Section 3 and Section 9 grants, Benefit Assessment Districts, State of California, the City of Los Angeles, and LACTC. In addition, Module 11 includes a bonding component which assists in balancing the capital program, if possible, in the cash flow analysis structure of the module.

## 4.5 OPERATIONS CASH FLOW MANAGER

The Operations Cash Flower Manager provides a summary of SCRTD farebox revenues, operating subsidies and grants, operating and maintenance costs and the capital program for buses. Additionally, a recap of the Capital Funding Plan from Module 11 is input to Module 10 so that a complete cash flow of all SCRTD operating and capital funds and expenses can be calculated.

Module 10 reads a variety of data from other modules relative to the operation of the transit system. Changes in the input must be made in the originating modules. Changes cannot be made in the module which accesses the data from another module. The user can make changes in the bus capital program as necessitated by SCRTD policy. The major inputs by the user are modifications to the annual base fare which assists in balancing the operations and the overall financial program, if possible, in the cash flow analysis structure of the module.

## 4.6 SUMMARY

This chapter presents some ideas relative to management strategies which can be quickly tested by running the appropriate modules. The user should refer to Table 3.1 to determine the Modules affected by changes in other Modules. In some cases, the user may be interested in sensitivity analyses in regard to certain variables, particularly escalation and other rates and in funding levels.

**Figure 4.3 Capital Cash Flow Manager**

METRO RAIL ALIGNMENT 1 MOD. MOS-2A
COMMITTED SYSTEM (STATIONS AND/OR LENGTH DEFERRED)
NO NEW METRO RAIL BONDS

REGIONAL TRANSIT FINANCIAL PLAN
SOURCES AND USES OF FUNDS FOR RAIL SYSTEM
CAPITAL PROGRAM

| SOURCES OF RAIL SYSTEM FUNDS | | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | TOTALS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LACTC | | | | | | | | | | | | | | | | | | |
| PROCEEDS FROM BONDS-phase 1 | | | 37.4 | 337.7 | 100.0 | 89.5 | 70.2 | | | | | | | | | | 634.8 | |
| PROCEEDS FROM BONDS-phase 2 | | | | | | 0.0 | 0.0 | 61.0 | 66.0 | 0.0 | | | | | | | 127.0 | |
| PROCEEDS FROM BONDS-phase 3 | | | | | | | | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | |
| STATE TRANSIT ASSISTANCE | | 28.0 | 12.6 | 13.5 | 6.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 60.1 | |
| SALES TAX RECEIPTS (35% PROP A) 1.0 | | 67.4 | 41.3 | 118.2 | 125.2 | 133.0 | 140.3 | 150.1 | 159.6 | 169.3 | 180.4 | 191.7 | 203.4 | 215.7 | 228.7 | 242.6 | 2368.5 | |
| INVESTMENT INCOME ( 7.10% 9.92% ) | | 0.0 | 0.0 | 9.1 | 13.6 | 10.9 | 6.6 | 9.0 | 9.2 | 10.6 | 12.5 | 14.0 | 16.7 | 21.7 | 27.4 | 33.7 | 195.0 | |
| TOTAL COMMISSION FUNDS | | 95.4 | 91.9 | 478.5 | 244.8 | 233.4 | 217.7 | 220.1 | 234.3 | 180.4 | 192.9 | 205.7 | 220.1 | 237.4 | 256.1 | 276.3 | 3385.5 | |
| (UTILIZATION COEFF.:PROP A PROGRAM) | | N/A | 3.74 | 3.42 | 3.09 | 2.84 | 2.64 | 2.15 | 2.19 | 2.24 | 2.32 | 2.45 | 2.61 | 2.77 | 2.94 | 3.12 | | |
| UMTA | | | | | | | | | | | | | | | | | | |
| SECTION 3 FUNDS MOS-1 | | 137.4 | 11.4 | 39.7 | 141.6 | 123.6 | 70.5 | 20.9 | 5.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 550.3 | 43% |
| SECTION 3 FUNDS MOS-2 | | 0.0 | 0.0 | 0.0 | 53.5 | 113.9 | 131.3 | 128.7 | 110.8 | 86.5 | 41.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 666.4 | 47% |
| SECTION 3 FUNDS MOS-3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| | | | | | | | | | | | | | | | | | 1271.7 | 48% |
| SECTION 9 FUNDS MOS-1 | | 15.8 | 5.3 | 14.5 | 20.7 | 18.2 | 13.2 | 2.5 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 90.6 | 7% |
| SECTION 9 FUNDS MOS-2 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| SECTION 9 FUNDS MOS-3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| | | | | | | | | | | | | | | | | | 90.6 | 3% |
| STATE OF CALIFORNIA | | | | | | | | | | | | | | | | | | |
| GUIDEWAY FUNDS MOS-1 | | 58.0 | 10.9 | 30.7 | 46.5 | 44.9 | 21.9 | 0.0 | 0.0 | | | | | | | | 213.1 | 17% |
| GUIDEWAY FUNDS MOS-2 | | 0.0 | 0.0 | 0.0 | 12.4 | 26.5 | 38.1 | 44.2 | 34.1 | 25.4 | 6.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 186.9 | 13% |
| GUIDEWAY FUNDS MOS-3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| | | | | | | | | | | | | | | | | | 400.0 | 15% |
| SCRTD | | | | | | | | | | | | | | | | | | |
| BENEFIT ASSESS. BONDS MOS-1 | | 0.0 | 6.4 | 25.8 | 42.5 | 42.9 | 11.7 | 0.0 | 0.0 | | | | | | | | 130.3 | 10% |
| BENEFIT ASSESS. BONDS MOS-2 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.0 | 31.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.0 | 4% |
| BENEFIT ASSESS. BONDS MOS-3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| | | | | | | | | | | | | | | | | | 186.3 | 7% |
| CITY OF LOS ANGELES | | | | | | | | | | | | | | | | | | |
| LOCAL ASSISTANCE MOS-1 | | 0.0 | 3.5 | 6.7 | 10.5 | 10.4 | 2.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 34.0 | 3% |
| LOCAL ASSISTANCE MOS-2 | | 0.0 | 0.0 | 0.0 | 5.7 | 12.2 | 18.3 | 17.3 | 14.2 | 10.9 | 5.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 84.5 | 6% |
| LOCAL ASSISTANCE MOS-3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| | | | | | | | | | | | | | | | | | 118.5 | 4% |
| PROPOSED SPECIAL FUNDING FOR MOS-2 | | | | | | | | | | | | | | | | | | |
| CITY PROPOSED - MOS-2 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| LACTC LOAN (MOS-3 REAUTHORIZATION) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ADV ROW ($4.4M);CITY OF LA | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | | | | | | | | | | | | | | | | | 0.0 | |
| UNIVERSAL CITY ROADWORK (SOURCE:FAUS) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| TOTAL OTHER FUNDS | | 206.2 | 40.5 | 178.4 | 333.9 | 392.6 | 330.3 | 245.1 | 164.7 | 122.8 | 52.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2067.2 | |
| TOTAL ALL SOURCES | | 301.6 | 132.4 | 656.9 | 578.7 | 626.0 | 548.0 | 465.2 | 399.5 | 303.1 | 245.6 | 205.7 | 220.1 | 237.4 | 256.1 | 276.3 | 5452.7 | |
| USES OF RAIL SYSTEM FUNDS | IMPLEMENTATION SCHEDULE | | | | | | | | | | | | | | | | | |
| RAIL TRANSIT SYSTEM PROJECTS | | | | | | | | | | | | | | | | | | |
| METRORAIL(MOS-1) | FY 1993 | 257.2 | 66.9 | 197.5 | 253.1 | 250.2 | 142.9 | 42.3 | 18.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1249.9 | |
| METRORAIL(MOS-2) | FY 1996 | 0.0 | 0.0 | 0.0 | 94.2 | 201.2 | 250.0 | 252.3 | 223.3 | 188.0 | 141.4 | 71.1 | 0.0 | 0.0 | 0.0 | 0.0 | 1422.0 | |
| METRORAIL(MOS-3) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| LONG BEACH PROJECT | FY 1991 | 63.0 | 58.3 | 200.7 | 311.5 | 174.3 | 21.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 826.7 | |
| CENTURY PROJECT | FY 1993 | 0.0 | 2.3 | 15.3 | 37.3 | 61.0 | 71.7 | 102.3 | 87.2 | 2.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 380.0 | |
| LRTC PROJECTS(MERGED) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| LRTC PROJECT (OTHER) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ROADWORK AT UNIVERSAL CITY | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| RAIL SYSTEM CAPITAL RESERVE | | 0.0 | 0.0 | 19.0 | 18.0 | 7.4 | -5.9 | -9.0 | -6.1 | -4.6 | -4.7 | -7.0 | -7.1 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ASSOCIATED LRT CONST COSTS | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| GENERAL RESERVE RAIL OPS COST | | 0.0 | 0.0 | 5.6 | 5.9 | 6.3 | 6.7 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 | 9.6 | 10.2 | 10.8 | 11.4 | 106.4 | |
| DEBT SERVICE LACTC BONDS-phase 1 | | 0.0 | 11.2 | 34.5 | 40.5 | 46.8 | 53.4 | 64.4 | 64.4 | 64.4 | 64.4 | 64.4 | 64.4 | 64.4 | 64.4 | 64.4 | 766.0 | |
| DEBT SERVICE LACTC BONDS-phase 2 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 5.5 | 11.4 | 11.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 13.4 | 108.7 | |
| DEBT SERVICE LACTC BONDS-phase 3 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| SB 1995 ESCROW | | 0.0 | 0.0 | 13.2 | 15.1 | 20.3 | 13.0 | 8.1 | -17.4 | -17.4 | -17.4 | -17.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| ADDITIONS TO CASH | | -15.6 | -5.7 | 170.6 | -227.1 | -141.4 | -5.0 | -8.2 | 18.6 | 50.5 | 39.9 | 72.3 | 133.3 | 149.5 | 167.5 | 187.1 | 592.9 | |
| TOTAL ALL USES | | 301.6 | 132.4 | 656.9 | 578.7 | 626.0 | 548.0 | 465.2 | 399.5 | 303.1 | 245.6 | 205.7 | 220.1 | 237.4 | 256.1 | 276.3 | 5452.7 | |
| BEGINNING BALANCES (SALES TAX) | | 259.3 | 243.7 | 238.0 | 408.6 | 181.5 | 40.1 | 35.1 | 27.0 | 45.6 | 96.1 | 136.0 | 208.3 | 348.1 | 497.6 | 665.1 | | |
| ADDITIONS TO CASH | | -15.6 | -5.7 | 170.6 | -227.1 | -141.4 | -5.0 | -8.2 | 18.6 | 50.5 | 39.9 | 72.3 | 133.8 | 143.5 | 167.5 | 197.1 | | |
| ENDING CASH BALANCE (EXCLUDING RESERVES) | | 243.7 | 238.0 | 408.6 | 181.5 | 40.1 | 35.1 | 27.0 | 45.6 | 96.1 | 136.0 | 208.3 | 348.1 | 497.6 | 665.1 | 852.2 | | |
| RAIL SYSTEM CAPITAL RESERVES | | | 0.0 | 19.0 | 37.0 | 45.1 | 39.3 | 29.5 | 23.4 | 18.8 | 14.1 | 7.1 | 0.0 | 0.0 | 0.0 | 0.0 | | |
| GENERAL RESERVES | | | 0.0 | 5.5 | 11.5 | 17.8 | 24.4 | 31.5 | 39.0 | 47.0 | 55.4 | 64.5 | 74.0 | 84.2 | 95.0 | 106.4 | | |
| ENDING CASH BALANCES | | 243.7 | 238.0 | 434.0 | 230.0 | 103.0 | 98.8 | 88.0 | 107.9 | 161.3 | 205.6 | 279.9 | 422.2 | 581.8 | 760.1 | 958.6 | | |

# APPENDIX A

# SPREADSHEETS: MULTIPLAN

# SPREADSHEETS: MULTIPLAN

## General

Spreadsheets are computer programs that operate on rows and columns of numbers, performing tasks ranging from adding and subtracting to computing values of complex algebraic expressions. The fact that they are easy to use and do not require computer programming experience has resulted in a wide variety of applications which include economic analysis, personal record keeping, income tax preparation, engineering calculations, and many others. All spreadsheets have the same basic capabilities. They differ in the syntax of commands, size, and additional features.

These notes show how to use Multiplan (registered trademark of Microsoft, Inc.) to solve a loan repayment problem. Multiplan is a powerful spreadsheet in its own right, and it provides a good starting point for other spreadsheets. The philosophy of the notes is "learning by doing," so they should be read only while sitting at a computer with Multiplan. Commands are introduced as needed and are then immediately used. No attempt is made to cover all facets of Multiplan. This approach provides an overview of spreadsheet capabilities and rapidly accelerates one to a functional level. Details can be mastered by referring to various books and manuals on whatever spreadsheet one chooses to use.

The following sections first show the planning required before using the computer and then present topics in a natural order of occurrence. This includes executing the Multiplan program, viewing the initial display, entering data and moving the cursor, and then proceeds to illustrate the commands necessary to solve the problem. Next, the commands for formatting the spreadsheet (including changing column widths) are presented, followed by instructions for printing the spreadsheet and storing it on disk for later use. The concluding sections summarize additional capabilities not used in solving the problem.

## Problem Planning

The first step in using a spreadsheet is to understand the problem. This entails knowing how to perform all calculations and laying out the spreadsheet. A loan repayment problem illustrates this process.

Suppose Wally Ryan borrows $5,000 for a fishing boat and agrees to repay the loan with ten yearly payments at 12% interest. The amount of a note at interest rate i for N years is given by:

Note = Loan * ( i/[1 - (1+i)^(-N)]),

where the asterisk denotes multiplication and the   indicates exponentiation operator. Wally's yearly note is:

$884.92 = 5,000 * (0.12 / [1 - (1.12)^(-10)]).

He plans to deduct interest payments from his profits before paying taxes, so he wants to know how much interest the will pay each year.

Any note has two components, principal and interest, which vary from year to year. The interest component at he end of a year is equal to the amount owed (principal) at the beginning of the year multiplied by the interest rate:

End of year interest = Beginning of year principal * interest rate.

Ryan pays $600 interest the first year (5,000 * 0.12). The remainder of the note reduces the principal:

Principal reduction = Note - Interest.

At the end of the first year, Wally owes $284.92 (884.92 - 600) less than at the beginning of the year, so his principal is $4,715.08 (5,000 - 284.92) at the beginning of the second year.

New Principal = Old Principal - Principal Reduction.

Interest payments for the second year are $565.81 (4,715.08 * 0.12), and so forth. The spreadsheet is to be displayed as in Figure 1.

Interest: 0.12

| Year | Principal | Note | Interest | Reduction |
|---|---|---|---|---|
| 1 | 5000.00 | 884.92 | 600.00 | 284.92 |
| 2 | 4715.08 | 884.82 | 565.81 | --- |
| 3 | --- | --- | --- | --- |
| --- | | | | |
| 10 | --- | --- | --- | --- |

Figure 1. Note Repayment Spreadsheet

Operating the Computer

Obtain a disk which has an operating system (a program which controls the computer) and Multiplan on it. Turn the machine on and insert the disk into Drive A. Place a blank, formatted disk in Drive B, so that the spreadsheet can be saved when it is completed. Respond to any initial date and time prompts, and wait until the computer displays the prompt A>. Type in MP (with or without capitals) to execute the Multiplan program. These instructions vary with the equipment used and the software available.

## Initial Screen Display

The screen will appear as shown in Figure 2. The entire spreadsheet is 4,095 rows by 255 columns, but only 20 rows and 7 columns are displayed on the screen. The #1 in the lefthand corner indicates that window, or section, #1 of the spreadsheet is being displayed. Row 1, column 1 is designated as R1C1 or r1c1. It is initially highlighted. The commands listed at the bottom of the screen generally refer to the highlighted cell by default. Further, the highlighted command, initially Alpha, is the command which would be executed if the RETURN key is depressed. Instructions are provided beneath the command line, in this case an instruction to select an option or type a command letter. The last line contains the current cell cursor location, the percentage of the spreadsheet which is still unused or free, and the name of the spreadsheet which is initially TEMP.

```
#1   1         2         3         4         5         6        7
1
2
3
---
19
20

COMMAND: Alpha Blank Copy Delete Edit Format Goto Help Insert
         Lock Move Name Options Print Quit Run Sort Transfer Value
         Window Xternal
Select option or type command letter
R1C1                              100% Free     Multiplan:  TEMP
```

Figure 2. Initial Screen Display

## Executing Commands and Help

The first command to learn is the Help command. Commands can be executed by using the SPACE bar to move the highlight from one command to the next and then pressing RETURN when the desired command is highlighted. It is easier to just press the first letter of the command to be executed. So pres H (upper case or lower case), and the help command will begin execution. One can go through the entire help document one page at a time by depressing N to see the next page, or can go to specific sections by pressing the indicated letter, such as F for formulas. Enter R (resume) returns one to the spreadsheet. Experiment with the Help command now.

Help can also be obtained during the execution of a command by pressing the question mark key. This causes the display of help messages to begin with the command currently being executed. It will be assumed throughout the remainder of the notes this will be done any time there is a need for it. If there are any problems with a command, it can usually be abandoned by pressing the ESC key.

Entering Alphanumeric Data

It can be seem from Figure 1 that it is necessary to enter headings. Alphanumeric data is entered by using the Alpha command. Press A and enter INTREST: (purposely misspelled) without pressing RETURN. Now correct the spelling by moving the edit cursor (under the text being entered) via simultaneously depressing CTRL and k (left) or l (right). Position the edit cursor under the R and then type an E so that the E will be inserted. The character at the edit cursor can be deleted with the DELETE key and the one before (left) with the BACKSPACE key. Enter the corrected data by pressing RETURN. (It can still be edited later, if necessary). After pressing RETURN, INTEREST: will appear in R1C1.

Moving the Cell Cursor

Moving the cell cursor between cells can be effected by pressing the arrow keys. Try it. If it seems awkward to move the right hand so far, then simultaneously depress CTRL and s (left), d (right), e (up), or x (down). Use whichever is more convenient. The cell cursor can be made to move an entire screen at a time by depressing:

- o Pg Up; to move up one page (20 rows)
- o Pg Dn; to move down one page (20 rows)
- o CTRL and left arrow; to move left one page (7 columns)
- o CTRL and right arrow; to move right one page (7 columns)
- o Home; moves cursor to cell R1C1.
- o End; Moves cursor to lower right cell of spreadsheet.

Entering Numeric Data

Move the cursor to cell R1C2. Enter the value 0.12 by pressing V to execute the Value command. Respond to it by entering .12 and pressing RETURN. Alternatively, the Value command can be automatically entered by entering the number. The Value command is also used to enter formulas, as will be seen later. Formatting the entries INTEREST: and 0.12, as well as all of the other entries will be done towards the end of the session when topics such as formatting and cell widths are considered. If a mistake was made in entering .12 (or any other data or formula), then use the Edit command to correct it or simply re-enter the data.

Editing

Editing is required to change INTEREST: to Interest: in R1C1. Put the cursor on that cell. There are different ways to edit: (1) Use the Alpha command and type Interest: (2) Press E to execute the Edit command. The contents of the cell will be displayed with the edit cursor past the last letter. Move the edit cursor under the N using CTRL k, delete it and the following letters with the DELETE key, type the correction interest , and then press RETURN to enter it. (3) Execute Edit, but instead of moving the cursor and then using the DELETE key, delete with the BACKSPACE key, type "nterest:" and press RETURN. The quotes around Interest tell Multiplan that alphanumeric data has been entered and not a formula. (4) Use the Alpha command and the procedure in Item 2 or 3 above but without the quote as in Item 3. It should be noted that it is not necessary for the edit cursor to be at the end of an entry when RETURN is pressed.

Practice

Practice cursor moving, data entry, and editing by moving to R3C1 and creating the remaining headings. Then go to R5C1 and input the year numbers. After the 1 has been entered in R5C1, instead of pressing RETURN and then moving the cursor, simply move the cursor. Multiplan recognized that the entry is complete and is prepared to receive another Alpha or Value entry. It assumes an Alpha entry unless a number or arithmetic operator (e.g., +) is entered which signifies a Value entry. If neither is desired, press the ESC key. Also enter 5000 in R5C3.

Formulas

The remaining entries are all the result of computations performed by formulas. Formulas are entered by pressing V or = to execute the Value command, and then entering locations and operands. For example, R5C3 needs to contain the formula for the note, which is based on the loan amount given in R5C2 and the interest rate given in R1C2. The calculation for a note is:

Note = Loan * ( i/[1-(1+i)^(-N)].

So move to R5C3, press V, and enter the formula

R5C2 * (R1C2 / ( 1 - (1+R1C2)^(-10) ) )

and then press RETURN. The amount of the note will be displayed in R5C3. The blanks in the formula have been inserted for clarity. That sometimes helps when parentheses are involved. Be very careful with parentheses; the number of left parentheses must always equal the number of right ones. Multiplan does not accept spaces in formulas as valid.

Operation Hierarchy

Operations inside of parentheses are completed, and then those results are processed from left to right by performing any exponentiations first, then multiplications and divisions, and finally additions and subtractions. For example, (2+4)*5+3^2 equals 39. The term in parentheses equals 6. It is multiplied by 5 to obtain 30. then 3 is squared before it is added to 30. Use parentheses if there is any doubt about how a calculation will be performed.

Copying

One method for completing the rest of Column 3 (C3) begins with the cursor in R5C3. Press C (for copy) and examine the options. Now press D (Down) since copying will be done down the column. The next prompt needs the number of rows into which the entry (the formula, not its resulting value) in R5C3 is to be copied, so input 9. The prompt also asks which cell is to be copied from, with the current cell being given as the default. Press RETURN to accept the default. The formula will be copied, and its value will be displayed. The formulas can be examined by using the Edit command and then pressing ESC.

Executing Commands with Options

If another cell were desired as the source ("from") option in the Copy command, the TAB key would be pressed to move from the number of rows option to the source option. The TAB key is typically used to advance from one major option to the next in commands, and suboptions use the SPACE bar (forward) or BACKSPACE key (backward). The TAB key only advances. So if a previous option entry needs to be repeated, keep pressing TAB and eventually the cursor will wrap around from the last option to the first one.

Absolute Cell Referencing

Commands which can refer to one or more cells, such as

Copy, require an understanding of Multiplan's cell referencing scheme. A single cell can be referenced by entering an R, the row number, a C, and then the column number. Such references are called absolute references. Multiplan uses a colon to indicate ranges of cells. For example, R3:13C2 refers to rows 3 through 13 of column 2; and R3C2:5 refers to row 3, columns 2 through 5. Rectangles of cells involving more than one row or column can be identified by their upper left and lower right corners, so R2C3:R8C5 refers to the rectangle having R2C3 as its upper left corner and R8C5 as its lower right corner. Unions of sets of cells are indicated by placing a comma between each set reference, and intersections are similarly indicated by a blank between the set references. Unions consist of all cells in any set, and intersections include only cells in every set.

Relative References

Relative references are similar to absolute references, except that they indicate where cells are relative to the current cell cursor position. For example, R[-1] refers to the value (not the formula) in the row above the cursor row. The minus indicates above and the 1 is the number of rows. Similarly, R[1] means one row below; C[-1], one column to the left; and C[1], one column to the right. Relative addressing symbols can be combined, so R[2]C[-1] means the value calculated in the cell that is two rows down and one column left. The colon cannot be used between two numbers as in absolute addressing. For example, if the cursor is in R1C1, then the absolute reference R3:13C2 must be written as R[2]C[1]: R[12]C[1]. Relative and absolute addressing cannot be mixed in one reference, so R[1] C3 is illegal. MULTIPLAN will detect such illegal references and provide a message when an attempt is made to process the entry.

Name References

It is sometimes more convenient to refer to cells by giving them names instead of remembering their locations. Enter N to execute the Name command and assign the name RATE (upper or lower case) to the interest rate given in R1C2. Just respond to the prompts and enter the name, and then press TAB to advance to the next option and give the reference R1C2. Names can be given to any set of cells that can be referenced. If a name is assigned and then forgotten, then execute the name command and use CTRL d and S to scroll through them (or use the direction arrows).

Practice and Blanking

Experiment with the referencing methods. Use the Name command to assign the name TWO to columns 1 and 2, and then use the copy command to copy them to columns 6 and 7. These extra columns can be erased by pressing B to execute the blank command. Try copying using the different types of references, and then blanking the extra columns. Finish by blanking rows 6 through 14 of column 3. It is not necessary to recalculate the note formula each time. Instead, put R[-1] in R6C3. This copies the value, not the formula, in the row above. Use the copy command to copy the formula R[-1] from R6C3 down the rest of the column. This efficiently propagates the original value in R5C3 down the entire column.

## More Formulas and Copying

Completing all calculations requires the entry of the formulas for interest and principal reduction in row 5 and copying them to the remaining rows. The interest formula is:

End of year interest = Beginning of year principal interest rate

which is entered using the Value command in R5C4 as C[-2]*RATE. The principal reduction formula is:

Principal reduction = Note - Interest

which is entered using the Value command in R5C5 as C[-2]-C[-1]. Make these entries and then copy them into the remaining rows. Notice that rows 6 through 14 are in error until the formula for the new principal,

New principal = Old principal - Principal reduction,

is entered by putting the formula R[-1]-R[-1]C[3] in R6C3 and then copied down the rest of column 3. After this is done, note that the tenth payment contains a principal reduction exactly equal to the principal owed, thereby cancelling the debt.

## Formatting

The spreadsheet is complete now except for formatting it. Enter F to execute the Format command. Its options are to format Cells, set a Default format, or to set the Width of columns. Press C to format the cells. The first three rows will look best if they are centered. Set the reference to these rows (R1:3) and TAB over to the alignment options. Use the SPACE bar to put the command cursor on CTR (Center), and press RETURN. Similarly, the year numbers (R5:14C1) should be centered. Use Format command to do this, and also TAB over to the Format section of the display and use the space bar to set Int (Integer). Finally, use Format command on the remaining numbers in R5:14C2:5 to set the alignment to the Right, Format to Fix(ed), with number of decimals (TAB from Format option) to 2. This final form should be fairly neat, although further experimentation might be worthwhile.

Printing, Saving, Clearing, and Loading

Make sure the printer is turned on, and then Press P to set various printing options and press P again to print the completed spreadsheet. Use the Transfer command to save the spreadsheet on disk or to perform any other operation involving the entire spreadsheet, such as clearing it. Press T and then S to indicate that the current sheet is to be saved. Change its name from TEMP to B:Note before saving it. The B: causes the file (NOTE) to be written on disk drive B: Then clear the screen by using the Clear option of Transfer. Now try using the Load options of Transfer to restore B:NOTE.

Windows

If the spreadsheet were rather large, then different sections of it can be defined as "windows" and manipulated to temporarily move two columns or rows close to each other. This can be quite helpful, for example, when entering data or formulas that are associated with distant columns. To illustrate this procedure, press W to execute the Window command, and then S to indicate that window #1, which currently includes the entire spreadsheet, is to be split. Next enter V to designate a vertical split and respond that the split is to occur before column 3. Use TAB and then the SPACE bar to indicate that these two sections are to be "linked" or set to scroll up and down simultaneously; the default is completely independent operation of each window. Now press RETURN to execute the command and create window number 2 from column 3 to the right.

Try moving the cell cursor down until it tries to go off the screen. Notice that both window numbers 1 and 2 scroll up simultaneously. Now press CTRL and w simultaneously a few times to move from one window to the other; alternatively, one may press ; (semi-colon) for the same effect. Move to window 2 and start moving the cell cursor right until it is ready to leave the screen; press it one more time. Column 3 disappears to make room on the screen for column 8 in window 2. Now columns 2 and 4 are placed next to each other. Restore column 3 to view by moving the cell cursor leftward until it appears. Finally, execute the Window command once more and use the Close option to close window 2 and return the screen to its initial condition.

Inserting and Deleting

Rows and columns can be inserted or deleted with the Insert or Delete commands. Press D and delete row 2, and then use Insert to restore it. All cell references in formulas are automatically updated to account for any changes made by insertions and deletions of entire rows or columns, with a notable exception. If cells are deleted which are referred to by formulas in non-deleted cells, then an error condition is indicated. A problem can also occur if parts of rows or columns are inserted or deleted. For example, copy row 3 to row 2 to save it, and then delete R3C1:4 and observe the result. Columns 1 through 4 of rows 4 through 14 are shifted up by one position, and this causes calculation errors. Correct these errors by copying row 2 back to row 3 and inserting row 4 from columns 1 through 4 (R4C1:4); also blank row 2 and the spreadsheet will be restored to its original condition.

Summary of Other Commands

Six commands were not used above. The Goto command can be used to move the cell cursor over long distances. Lock prevents the contents of certain cells or of all formulas from being altered; it can also "unlock" them. Move first copies a set of rows or columns and then deletes the old ones; cell references are updated. Options can suppress recalculations until they are desired or silence the audible alarm. Sort can perform sorting, and Xternal copies data from another spreadsheet into the current one. RUN can perform DOS commands without leaving Multiplan.

Functions

A variety of functions can be used in formulas. Examples include summing, averaging, various mathematical and statistical functions, and even the net present value function. Use Help to examine them.

Quitting

To quit using Multiplan and return to the control of the operating system, press Q. Multiplan will ask for confirmation that quitting is desired before terminating.